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AUTHOR Otte, Richard
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ABSTRACT

The testing and revision phase of REACT (Relevant Educational Applications of Computer Technology) and CUES (Computer Utility for Educational Systems) is summarized. REACT is a training course for teachers and administrators designed to familiarize them with the use of computers for instructional and administrative purposes. REACT course materials are designed for hands-on interaction between teachers and administrators and the computer; training is accomplished by a combination of instructional manuals and interaction with a computer. By the end of the contact year every training manual was revised, based on data from in-house tests, consultant reviews, and results from various test sites. Tests showed that the manuals were effective in either self-instruction or group presentation modes. It was found that the greatest need for assistance with the training program always arose during the set-up phase and, after that, any problems that arose could be handled by telephone. This report contains sample units, a sales brochure from the publisher, and a bibliography of books and articles relating to computers and their uses. (JY)

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Technical Report No. 10

REACT:
RELEVANT EDUCATIONAL APPLICATIONS OF COMPUTER TECHNOLOGY

CUES:
COMPUTER UTILITY FOR EDUCATIONAL SYSTEMS

JANUARY 31, 1972

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Technical Report No. 10

RELEVANT EDUCATIONAL APPLICATIONS OF COMPUTER TECHNOLOGY
(REACT)
COMPUTER UTILITY FOR EDUCATIONAL SYSTEMS (CUES)

January 31, 1972

Conducted under Contract No. OEC 4-7-062871-3059 Amendment 6
Bureau of Educational Research, U.S. Office of Education
Richard Otte, Project Officer

by Northwest Regional Educational Laboratory
710 S.W. Second Avenue/500 Lindsay Building
Portland, Oregon 97204

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INTRODUCTION

The purpose of this report is to summarize Phase II development work of REACT (Relevant Educational Applications of Computer Technology)--CUES (Computer Utility for Educational Systems). Phase II was devoted to testing and revision of training systems for teachers and administrators developed during Phase I.

The report is organized as follows:

- o Background of Development Support
- o Research Base
- o Description of the Products Tested
- o Testing Program (Goals, Description of Tests, Description of Test Sites, Analysis)
- o Summary of Results
- o Actions and Recommendations

The report also contains sample units, a sales brochure from the publisher and a bibliography of books and articles relating to computers and their uses.

BACKGROUND OF DEVELOPMENT SUPPORT

Two sets of activities, CUES (Computer Utility for Educational Systems) and REACT (Relevant Educational Applications of Computer Technology) developed from two separate sources but with a common theme. At the inception of the Northwest Regional Educational Laboratory, support from the U.S. Office of Education was sought to develop a set of programmatic activities that would assist schools to become knowledgeable about and effective in the use of computer technology in the areas of instruction management and administration. Analysis by the Laboratory staff indicated the three general areas of involvement of the computer to be technically and economically feasible.

The first area of the computer in education involves instruction in the public school system about the effect of computers on society. This would be a general course or unit of instruction with which all students would come in contact. Such a course or unit of instruction would deal with the impact of machinery on the daily life of people in this country and throughout the world.

The second area of instructional use of computers is use of the machine as a problem solving tool for other courses in the curriculum. This could affect all areas of the curriculum through use of the machinery as a fast calculator, a simulation devise, an element of a gaming problem, etc.

The third area involved the use of the school administration and management systems. This would improve the match between students, curriculum,

facilities and resources. Further, the implementations in this area would fully utilize the machinery and tend to optimize applications in the other two areas.

NWREL made several applications to the Division of Educational Laboratories in the Bureau of Research in the U.S. Office of Education for programmatic support funds. Applications for funds culminated during November of 1968 with tentative programmatic approval. At that time financial consideration led this endeavor to be placed in a "hold" position.

Another branch of the Bureau of Educational Research--the Division of Vocational and Continuing Education--awarded two RFP's, one to General Learning Corporation and one to IBM Corporation. The purpose of these RFP's was to establish the technical and economic feasibility of providing services from a central computer to 50 schools serving 100,000 students in a 50 mile radius.

The studies proceeded independently, each making several different assumptions about the work load the students would create, the type of administrative applications to be provided and the form of access to the machine. However, both studies required utilization of some type of keyboard instrument as input to a time-sharing system for the use of students in problem solving and some kind of a batch mode of entry for administrative data.

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When both studies were completed, there was a variance in the type of machinery required and, therefore, in the costs of hardware and programming. A third contract was let with Computation Planning, Inc. to synthesize the results of the GLC and IBM studies and to recommend changes that would reduce the costs. In essence, the synthesis was accomplished and Computation Planning achieved the cost reduction by shifting from a time-shared computing system to what they have characterized as remote job entry system with a quick batch operation.

The ComPlan report was submitted to the Bureau of Research approximately the same time as the REACT program proposal was placed on hold, November of 1968. The CUES program was faced with the same financial considerations experienced by REACT. Therefore, both were placed in a semi-hold category. Semi in the sense that (1) Computation Planning, Inc. had a small follow-on contract to begin considering educational specifications for the training program, software procedures, machinery acquisition procedures and other specific tasks identified in their report.¹ (2) The Northwest Regional Educational Laboratory was to continue to receive some minimal funding to continue planning for the implementation of REACT.

In about March of 1969, the Division of Educational Laboratories and the Division of Vocational and Continuing Adult Education decided to invest a small amount of funds in the first step toward implementation. An analysis of the CUES and REACT programs indicated a point of common interest in the area of instruction and a common strategy, through teacher and administrator training, to a solution of the penetration problem. Development in the common

¹See Appendix A for a copy of their specifications.

areas and strategy was deemed to have a high order of pay off. While CUES and REACT have some difference from a total program point of view, the capitalization on an activity of mutual concern was instituted.

NWREL was awarded a \$165,000 contract to develop prototype training materials necessary for training teachers and administrators to implement CUES. The development of these prototype materials is described in the REACT/CUES Project Report, January 31, 1970.

An additional contract was awarded in June 1971 for testing and revising of the prototype materials. That testing and revision is the subject of this document.

RESEARCH BASE

Operating under the Elementary and Secondary Education Act of 1965 and the National Defense Education Act of 1958, the U.S. Office of Education has funded many projects relating to education and computer technology. The findings and recommendations of five studies, in particular, provide basic research information supporting Program REACT. They are:

1. Education in the 70's: A Study of Problems and Issues Associated With the Effects of Computer Technology on Education. The Program of Policy Studies, George Washington University, October 1967.
2. IBM: Feasibility Study for a Remote Terminal Central Computing Facility Serving School and College Institutions (Vol. I: Functional Requirements; Vol. II: Preliminary Specifications).
3. A Feasibility Study of a Central Computer Facility for an Educational System. General Learning Corporation, February 1968.
4. A Single Integrated Central Computer System for Secondary Schools and Junior College. Computer Planning, Inc., May 1968.
5. Preliminary Curriculum and Training Specifications for the Computer Utility for Educational Systems. Computation Planning, Inc., October 1968.

A great number of education and computer related projects are funded through other federal government manpower and training functions. An analysis of projects listed in monthly bulletins of the U.S. Government Research and Development Reports Index provides an additional relevant research information.

Private industry has recognized the need and potential of computer technology in education. The research reports of General Learning Corporation, Westinghouse Learning Corporation, Educational Systems Division of Radio

Corporation of America, International Business Machines Corporation and Science Research Associates are a third source of research data.

In addition to these sources of information, the findings of the following studies have been considered as a basis for projecting productive future educational needs of computers:

1. Computer Services Needs Survey. Mark Greene and Al Selinger, May 1969, Northwest Regional Educational Laboratory.

Although data used for this study were collected from a limited number of interviews, the procedures used for selecting respondents provide a good basis for confidence in the results of the study. The conclusions drawn from the results are: Several sources of information about computers exist concerning services used by district administrators, high school administrators and math-science teachers. The data indicate, however, that other teachers make little use of the available informational resources.

With the exception of the math-science group, little course work in computer technology was evidenced.

With the exception of math-science teachers, school personnel in the groups surveyed had little practical experience with computers. This would seem to imply that course work in computer technology could profitably focus on school personnel other than the math-science teaching groups.

Nearly everyone interviewed was able to list at least one way in which he was using computer services. As evidenced by

the commitments for future computer services, the need for computer literacy did not appear to be diminishing. Endeavors aimed at familiarizing school personnel with computer technology seemed to be quite appropriate.

Not only are computer services presently in general use, they also are regarded as relatively important by the respondents of each of the survey groups.

While the demand for computer services appeared immediate and high, familiarity with computer technology was low. These findings dictated the need for greater familiarity with computers on the part of school personnel.

2. A Survey of Computing Activities in Secondary Schools. Charles Darby, Arthur Korotkin and Tania Romashko, October 1970, American Institutes for Research.

Secondary school computer use for instructional purposes has increased at a rapid rate in recent years according to the report. In a 1966 study, Bangs and Hillstad reported 1.7% of public secondary schools used computers for instruction. The AIR study, just four years later, showed 10-15% of public secondary schools making such use of computers. The percentage continues to rise.

Although the overall purposes of the applications reported in the AIR study varied widely, there was a general emphasis on using the computer as a tool to accomplish subject matter goals rather than on learning about the computer as an end in itself. According to the study, teachers did most (39.2%) of the software

development for instructional applications. In addition, teachers were either developing their own materials (2/3 of the time) or using materials from other sources--most often hardware companies.

The computer oriented curriculum materials generally available to teachers were often of doubtful quality and usefulness. If the teacher developed his own materials, he was handicapped by lack of sufficient time for thorough analysis and documentation of the unit, and by a lack of training and experience in curriculum development. Probably the most serious problem with teacher developed materials was the frequent misuse of the computer in the teaching of concepts which might be better and more inexpensively taught through other media. Most teacher training programs neglected to emphasize the development of criteria for judging the appropriateness and usefulness of a computer application for the classroom.

The needs identified in the AIR Study, which was supported by the National Science Foundation, are detailed in the following excerpts:

- o Needs for future expansion of computer use among instructional users typically involved one or more of the following: funding, training of staff and information.
- o Information about curriculum development and what other schools were doing with computers was most wanted. One suggestion was a curriculum program library where programs would be available to anyone expressing interest in them.

- o The dominance of computer applications by the mathematics curriculum is even more marked than that of problem solving and EDP skills training. In most of the schools surveyed, computer applications have been well integrated into the mathematics curriculum. However, applications have very rarely spread to other subject matter areas to any extent.

Most typically, instructional use of computers starts with mathematics departments in the schools. If use does spread to other departments, it is normally through the efforts of mathematics teachers. Why computer use has not spread more rapidly is very difficult to determine.

Mathematics teachers indicated that they have met with considerable resistance when attempting to encourage colleagues in other departments to develop computer applications. It is evident that the computer quite readily lends itself to use in the mathematics course. On the other hand, applications in areas such as social studies, English, etc., are less obvious, and probably require considerable imagination and interest on the part of teachers in these subject areas.

The Evaluation Committee for the Huntington Computer Project directed by Dr. Ludwig Braun interviewed many project teachers and sent out questionnaires to determine successes and failures of the project and future needs. Teacher training, specifically in the skills required to evaluate, discriminate, select and define complete specifications for curriculum applications emerged as the most pressing and continuing need. To quote one teacher:

We don't need to spend our inservice time learning to program. We need to develop some quality criteria for judging and designing units. If we can write the specs for applications for our own classrooms, we can get graduate students (at Brooklyn Polytechnic) to do the programming.

The needs documented in the AIR Study and in the Huntington report are, simply stated, for:

Adequate teacher training

The establishment of a national "Clearinghouse" of information about programs and curriculum units

Further computer oriented curriculum development-- particularly in nonmathematical areas

3. Education in the 70's: A Study of Problems and Issues Associated With the Effects of Computer Technology on Education. October 1967, George Washington University.

The following recommendations were included in the report:

It is anticipated that the greatest need and most ready application of the computer to education will be in data processing including such management techniques as budgeting, planning, inventory, scheduling, evaluation of progress and personal utilization. Some will involve relatively simple bookkeeping; others will require complex and sophisticated model building.

The use of limited or ancillary instructional applications of computers such as dial access storage and retrieval or calculation will make our libraries and data banks more efficient. It will also further the application of the computer to the area of information handling where we may be losing ground because of the flood of new information.

Some use will not only satisfy serious current needs, it will facilitate the introduction of instructional (CAI) and other uses of the computer.

It is recommended that the non-instructional applications of the computer to meet existing needs be facilitated so that familiarity with the use of the instrument may develop while technological developments necessary to its instructional application are underway.

The needs for increased and improved teacher training are made more pressing by the demands for new populations to be educated and the increasing obsolescence rate of existing training. It is urged that schools of education and other

teacher training institutions and agencies be assisted to improve their familiarity with and investment in the use of the computer in education. This may be best accomplished through actual use of the computer in administrative and instructional modes.

That careful investigation be undertaken of the societal trends resulting from the introduction of the computer to education. Particular attention should be given to such critical areas as depersonalization and invasion of privacy which may be processes already affecting our mass culture. The effect of technology and technological models on human values and social structure merit attention.

That every effort be devoted to achieve the use of the computer as a tool rather than permit its emergence as a teacher or psychological model for the learner.

That a continuing dialogue on the relationship of education, technology, and human values be facilitated to determine and assess objectives, effects, and responsibility.

DESCRIPTION OF THE PRODUCTS TESTED

At the beginning of the Phase II Contract period, a prototype training system had been developed. It was organized in three parts:²

- o Course I--Identical for teachers and administrators

A set of nine manuals, introducing the educator to computer equipment and operation, terminology, uses in education, impact on society, and man-machine communication.

- o Course II for teachers

A set of five manuals in five subject areas, including 40 "application units" as specific hands-on demonstrations of how the computer can be used to enhance and extend the curriculum.

- o Course II for administrators

A set of eight manuals, based on a miniature information system called MIDAS, which is used as a vehicle to explore "state-of-the-art" applications of the computer in school administration.

In all three courses, the materials were designed for hands-on interaction between teachers or administrators and the computer. The training was to be provided by a combination of instructional manuals and interaction with a computer.

²A complete description of the manuals in the training system can be found in Appendix B.

TESTING PROGRAM

Goals of the Testing Program

1. To obtain concrete data as the basis for revision of all materials.
2. To determine the effectiveness of the materials when used for self-instruction as compared to group presentation.
3. To determine how much assistance from the developers is required when a school or group implements the training system.
4. To determine what additional manuals were needed to more effectively implement the training system.
5. To determine the need for and training necessary for the person who acts as local coordinator in implementing the training system.

The desired information was obtained to meet all of these goals, and to enable the developers to take appropriate action as summarized in a later section.

Description of the Tests Conducted

Three separate kinds of tests were conducted, in an effort to obtain as much data from as many different sources as possible.

The first test was an informal in-house trial. "Typical" untrained subjects were selected to go through the training system as would a teacher or administrator. They provided a large volume of feedback which was carefully documented and used as one of the bases for later revision.

Another in-house test was provided by two consultants who were brought in to review all of the materials and report on their findings. The consultants were selected on the basis of their broad experience in the educational uses of computers, development of computer-based curriculum applications, and experience in the training of teachers and administrators. Their detailed reports provided another basis for revision. These reports are not contained in this document but are on file at the Laboratory.

The most objective and comprehensive testing was conducted outside the Laboratory. A number of test sites were selected, and various modes of presentation of the materials were tried at the different sites, as described below.

Description of the Test Sites

In addition to the in-house bench testing and consultant review, tests were conducted at the following sites:

- o New York Institute of Technology, Long Island, New York
- o North Bend, Oregon School District
- o Multnomah County Intermediate Education District, Portland, Oregon
- o The University of Oregon, Eugene, Oregon
- o Portland State University, Portland, Oregon

At New York Institute of Technology, an announcement was mailed to every school administrator in a region comprising 90 school districts. The course was offered for in-service credit on an experimental basis and was coordinated by a member of the faculty of NYIT.

Thirty-five teachers and administrators enrolled in the course. They were all untrained in computers and were drawn from many disciplines.

Pre-tests and post-tests were administered for each manual. Enrollees studied the manuals on their own, and the faculty coordinator held informal weekly "help sessions" to answer any questions that came up. Thus, the training system was presented in self-instructional mode with help available.

The North Bend School District agreed to enroll ten teachers in the system and to assign one teacher as local coordinator. The coordinator had had experience with computers but not in a school setting.

North Bend is a small town on the Southern Oregon coast, a distance of four hours by car from the Regional Laboratory in Portland. Thus, the assistance available from the developers was almost as limited as that available to the New York group.

Again, the teachers had no previous experience with computers and represented a variety of disciplines.

Pre and post-tests were administered to each teacher for each manual. The teachers studied the manuals on their own and scheduled an hour each week to meet with the coordinator, who answered any questions they had (and documented these questions and answers) and administered the tests.

In the Multnomah County I. E. D., the materials were used by an experienced computer educator to teach a course in group presentation mode. The class met for three hours each week for eleven weeks. Pre and post-tests

were administered for each manual. The teachers received in-service credit for the course.

The University of Oregon was the setting for testing the administrative applications part of the course. The course was made available to graduate educational administration students for credit. A teletypewriter and private telephone line were installed for the use of the students as their time allowed. The Laboratory provided a consultant one night a week for informal troubleshooting and supervision. The on-site supervisor, an assistant professor with very limited knowledge of computers, controlled the flow of materials and monitored the administration of pre-tests and post-tests.

At Portland State University, a graduate class called "Methods of Science Teaching" tested the Science Application Units. Most of the students were certificated science teachers with no experience in using computer applications in science.

The students learned to use a terminal, then used the application units independently, on an interactive basis with the computer.

Analysis Procedure

At NYIT, all pre and post-test data for all test sites were entered into a computerized system called Automated Instructional Management System (AIMS). Data from two of the other test sites was also entered into this system. For every manual, each objective had been keyed to specific test items and to the specific portions of the manual that were developed to meet

that objective. The AIMS system provided item analyses, individual student performance analyses for each test, and group performance data for each objective in each manual with reference to page and paragraph.

In all cases where the percentage of correct answers for an item fell below 80 percent, the corresponding sections in the materials were rewritten to clarify or simplify the concept being taught, or the test item was clearly shown to be in error and rewritten.

SUMMARY OF RESULTS

The first and major goal, to obtain revision data, was realized. Detailed data by test item is not included in this report but is available from the Laboratory.

Every manual was revised by the end of the contract year--some minimally and some extensively. The bases for all revisions made were the in-house bench test, the consultant reviews, and the data provided from pre and post-tests.

The second goal, to determine the effectiveness of self-instructional vs. group presentation in using the materials, was also realized. The data shows that 71 percent of the NYIT students achieved an average score of 70 percent or better for all manuals, in self-instructional mode. The group presentation class taught in Portland shows that 72 percent of the students achieved the same success rate. Apparently, the mode of presentation does not contribute significantly to success, and the materials adapt well to either mode.

The third goal was to determine the amount of assistance needed from the developer. In conducting tests on the other side of the country, in the same city, and a half-day's drive away, it was found that the greatest need for assistance always arose during set-up: orienting the coordinator, supplying materials and tests, and establishing procedures. After that, any problems that arose could be handled by telephone.

It was established in interviews with the local coordinators that the initial set-up problems could be taken care of for the most part by an adequate "Set-Up Manual" or User's Guide plus an initial visit from a developer. This new manual was then written.

At the three test sites which had local coordinators, it became obvious that it is indeed essential to have such a person available. At NYIT, in the beginning, no single person was so designated. After a coordinator was named and clearly took over all responsibility for the course, the program functioned smoothly.

The coordinator's level of training in computers does not seem to be highly significant. At NYIT the coordinator's background in computers was very limited, but he completed studying all of the materials himself before he began to help students. At the University of Oregon the coordinator studied the materials along with or slightly ahead of the students. In North Bend the coordinator had more experience, but it was in an environment very different from the school setting and using very different equipment and languages. He, too, studied the course materials before helping students and found that to be sufficient preparation.

ACTIONS AND RECOMMENDATIONS

Actions taken as a result of the testing program were:

- o All manuals and programs were revised as indicated by the results of the testing.
- o A Users Manual was written.
- o In making arrangements for the REACT training system to be published, it was established that initial "set-up" assistance and orientation would be provided for anyone acquiring the system.

A contract has been awarded to a publishing company for disseminating the products of this development project. Appendix C contains one of their brochures describing the materials now on the market. Appendix D contains samples of a curriculum unit and an administrative unit. These are representative of the entire set developed in this project.

The first manuals in the series, REACT USERS MANUAL: ADMINISTRATORS VERSION and REACT USERS MANUAL: TEACHERS VERSION, were the last to be written and include, along with a description of the courses and some instruction on the teletypewriter, recommendations for how to use the training materials. The next paragraphs are summaries from those manuals.

While this training system is written to be largely self-instructional, testing has shown that it is not practical for a novice to attempt the course without some orientation. A user should also have available at least occasionally

a person who has been through the system and is somewhat familiar with the hardware.

In a formally structured environment such as a pre-service or in-service course, the materials are flexible enough to provide either two quarters or two semesters of work. The first course--through Computers in Education: Part III--can stand alone as a general introduction to computers and an overview of computers in education. The second course--the Application Units (either Teacher Applications or Administrator Applications)--should be preceded by the first course. It is designed for the person who wants a much more thorough knowledge of the computers in the curriculum or in school administration. In a formally structured course, the materials have been used both with and without an instructor. The most workable plan is to have decreasing involvement of an instructor through the first course, leading to almost total self-study in the second course.

There are other ways in which the system can be used. Each course could be covered in an intensive one-week workshop. This would require the availability of a supervisor and one teletypewriter per person. (On a more relaxed schedule, a number of persons could dovetail their use of the teletypewriter.)

Still another possibility is to leave a teletypewriter and the course materials in a school and allow people to work on them as time and motivation permit. The effectiveness of this method depends, at least partly, on the degree of supervision and the kinds of motivation (graduate hours, salary credit, released time, etc.).

Finally, there is the option of selecting individual units from the course materials for workshops or other one-time demonstrations. This should only be done by persons familiar with the materials because most units require prerequisite skills from other units.

Each manual has a pre-test and post-test provided with it. A person who scores 80% or over on the pre-test may exercise the option of skipping the unit or skimming it lightly. A user who scores less than 80% on the post-test should review the unit, paying careful attention to correcting his errors, before proceeding.

APPENDIX A:

SPECIFICATIONS FROM COMPLAN

Submitted to:

U. S. OFFICE OF EDUCATION
400 Maryland Avenue, S. W.
Washington, D. C. 20202

23 May 1969

PRELIMINARY SPECIFICATIONS FOR THE
DEVELOPMENT OF THE CURRICULUM FOR THE
COMPUTER UTILITY FOR EDUCATIONAL SYSTEMS (CUES)

TR-209-4

COMPUTATION PLANNING, Inc.
Suite 520
5401 Westbard Avenue
Bethesda, Maryland 20016

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* * * * *		

Section 1 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe an overall plan for the development of a computer-oriented curriculum to be presented to students in grades 9-14, teachers, and school administrators. This curriculum will be a component of the Computer Utility for Educational Systems (CUES).

1.2 DOCUMENT ORGANIZATION

Section 2 contains a summary of the various areas to be covered by the curriculum, and indicates the type of instruction each group of CUES participants will receive.

Section 3 describes the general approach to be taken in specifying, procuring, and implementing curriculum elements.

Section 4 discusses the curriculum.

Section 5 discusses the teacher and administrator training courses.

Appendix A contains an overview of the CUES Program, and lists general objectives of CUES including those that are indicative of the required curriculum structure. Familiarity with the contents of Appendix A is essential to an understanding of the overall curriculum development plan, and is assumed henceforth.

Appendix B lists documents that will be produced as specifications for the various curriculum elements.

Section 2

SUMMARY OF THE CUES CURRICULUM

2.1 GENERAL

This section lists the general areas in which instruction is to take place as a part of the CUES Program, and describes the overall content within each area. Curriculum elements will be developed for four categories of CUES participants: secondary school students, junior college students, teachers, and administrators.

Although the computer facility is designed to meet the needs of the curriculum, reference to capabilities of the computer facility serves as a useful background for presenting a refined description of the curriculum. Curriculum elements, then, are defined to some extent by the intended use of the CUES computer facility as described in Appendix A. The computer facility can be viewed as presenting two broad capabilities: a means for performing instructional "jobs"* originated by students and teachers (a class of jobs devoted to problem solving, demonstrations, or training); and a means for performing administrative jobs originated by teachers and administrators (pertaining to support in the areas of school operations and planning). There is an overlap in that teachers are expected to use some of the administrative support capabilities of the computer, in addition to the problem solving, demonstration, and training capabilities; there is also likely to be an overlap in the case of administrators, although the latter will probably be primarily interested in the computer as an administrative tool.

*A "job" is a sequence of activities performed by a computer in accordance with directions supplied by a user.

With respect to students, the broad objectives of the CUES Program will be to provide education and training in the nature and uses of computers. As a result of experience gained through use of CUES, students should learn that computers are information processing tools used in performing a broad range of services for society, for organizations, and for individuals. Therefore, practical experience will be emphasized as a means of substituting understanding for mystique. The curriculum will focus upon such areas as computer concepts, programming languages, problem solving, computer applications, and actual usage of the computer by students. The curriculum will be primarily oriented toward secondary school and junior college students (grades 9-14) for instructional usage; administrative support will be oriented toward primary school through undergraduate college (grades K-16).

A CUES teacher training course will be directed toward preparing teachers to present material developed for use in the curriculum. As teacher-oriented administrative support system facilities are developed, provision will be made for their incorporation into the teacher training course.

Training courses will be developed for presentation to administrators or other users of the administrative support system.

Development of the curriculum and development of related teacher training course elements will be closely coordinated. Development of both teacher- and administrator-oriented administrative support system training course elements will be coordinated with specification and development of the support system. However, because little inter-dependency exists between the curriculum and the administrative support system, these separate activities may be implemented without the necessity for close coordination with each other.

Section 3 CURRICULUM DEVELOPMENT

3.1 GENERAL

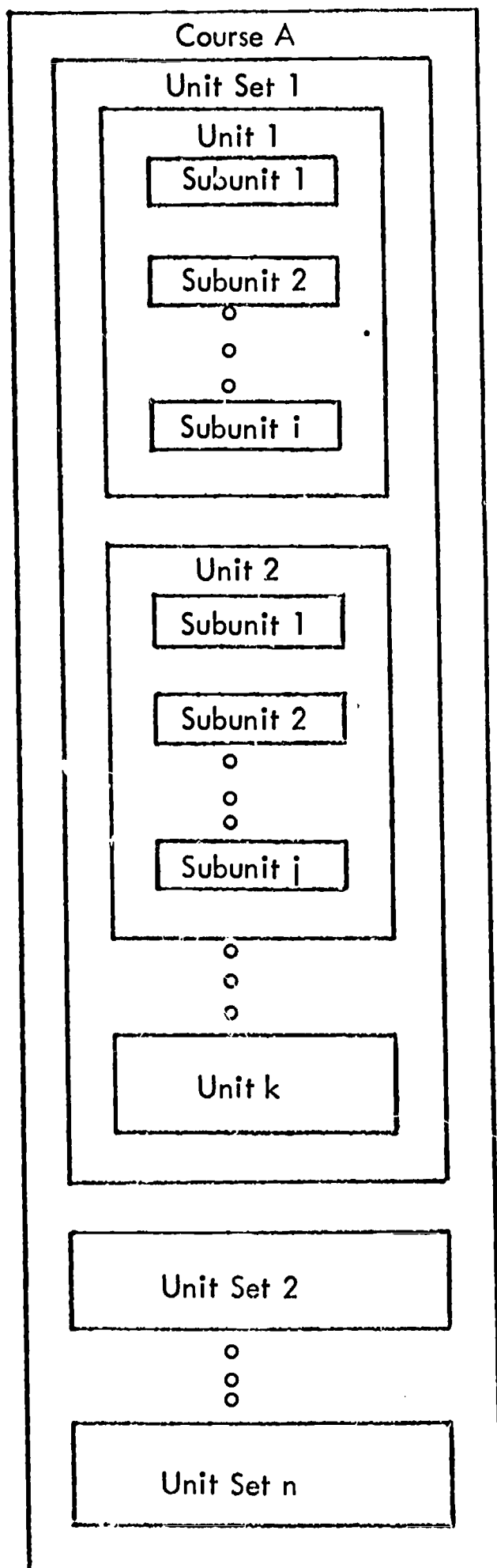
This section explains the approach to be used in developing elements of the CUES curriculum, and discusses considerations that generally apply to all curriculum elements. The approach described below is one that emphasizes the systematic specification and acquisition of curriculum elements in such a way as to solicit a variety of ideas and still maintain a basis for comparative evaluation.

3.2 MODULARITY OF CURRICULUM ELEMENTS

Both entire courses and elements to be introduced into other courses will be separated into self-contained modules designed to enhance flexibility in course structure and presentation. Modules will consist of unit sets, units, and subunits as shown in Figure 3-1. Modules will be so structured as to permit a school to make less than a full commitment to CUES curriculum elements.

Figure 3-1

MODULAR STRUCTURE OF THE CUES CURRICULUM

Course

A course is the largest element in the curriculum

Unit Set*

A unit set is another curriculum element. A course could consist of one or more unit sets.

Unit*

A unit is a smaller curriculum element than a unit set. Most units will be relatively self-contained, others will have a specific sequence for presentation, where one unit is prerequisite to another.

Subunit*

A subunit may be a single lesson, a day's assignment, a week's assignment, etc.

* These curriculum elements could be such that a given element would be used in several different courses.

3.3 SPECIFICATION DOCUMENTS

A specification document will be produced for each curriculum element to be developed for use in CUES. These documents will be designed to serve as the basis for requests-for-proposals (RFP's) intended for circulation to prospective contractors who might be qualified to produce the specified curriculum elements. It is expected that subsequent proposals will then be used to contract* for labor and materials required to implement the curriculum.

The content of specification documents will be generally as indicated in the following sections:

3.3.1 Scope

Each specification will pertain either to logically related units constituting a course, or to one or more units designed for incorporation into an existing or a new course. Specification documents will both describe a product to be procured and include pertinent background information, the purpose of which will be to minimize the demands upon prospective bidders to acquire additional reference material. The intent of this approach will be to encourage a response from all organizations qualified to produce the desired product.

3.3.2 Curriculum Element Versions

It is anticipated that student curriculum elements will in many cases be developed in two versions in recognition of different potential achievement levels among students.

*In discussing contracts and contractors, it should not be assumed that profit making organizations are necessarily the only prospective contributors to the CUES curriculum. On the contrary, such organizations as regional educational laboratories, school districts, not-for-profit corporations, universities, etc., are considered to be very likely sources for the curriculum products to be developed. However, no matter what type of organization produces a curriculum element, the scope of work should be clearly outlined in a work statement, and delivery dates should be both recognized and met in order to promote a controlled and smooth implementation of the CUES Pilot System. There is, of course, near certainty that improvements will be made upon the curriculum as experience is gained and new developments take place.

3.3.3 Intended Audience

The intended audience for each curriculum element will be specified. However, certain curriculum elements, while directed primarily toward students, will also be used in teacher training.

3.3.4 Costs

Specification documents will direct the attention of prospective contractors to the low cost per student CUES objective, and will specify that recommended curriculum materials be economically feasible for use in instructing many thousands of students.

3.3.5 Performance Objectives

Curriculum elements will be specified in terms of major performance objectives. Contractors will be required to subdivide and detail each major objective until an entire unit or unit set is described by numerous logically continuous performance objective statements.

3.4 PROCURED CURRICULUM ELEMENTS

It is expected that RFP's will be developed from the procurement specifications described in Section 3.3, and that evaluation of resultant proposals will culminate in the selection of one or more contractors to produce curriculum elements. This section, then, describes the product that a given contractor is expected to produce as defined, presumably by contract based upon a specification document and a corresponding proposal.*

Note that specification items (in addition to those items listed in Section 3.3) will require that proposals respond appropriately to the curriculum element characteristics described below.

*It is assumed that contractor selection will consider such factors as: (1) conformance to original specification items, such as intended audience and major performance objectives, and (2) characteristics, such as economic feasibility and relative benefit, of the proposed approach as determined after careful evaluation. Criteria for the evaluation of proposals will be produced for individual specification documents.

3.4.1 General Characteristics of the Product

The product produced by a contractor is expected to exhibit the following general characteristics:

- o The content will conform to specifications
- o The presentation will be tailored appropriately to the intended audience
- o Active participation on the part of the audience will be encouraged
- o The product will be described in terms of performance objectives and will be so implemented as to ensure that these objectives will be achieved by the intended audience.

3.4.2 Specific Characteristics of the Product

In addition to general characteristics described above, the contractor's product is also expected to conform to certain specific characteristics, described below, that are believed to be essential for success in the CUES environment.

3.4.2.1 Extent of Modularity. Each unit will be sufficiently self-contained and compact as to facilitate its use in any unit sets or courses in which coverage of the subject matter would be beneficial (assuming that the audience has adequate background). Units will lend themselves to upgrading and replacement in order to maintain relevancy in light of future developments.

3.4.2.2 Adaptability for Use in Independent Study. It is recognized that many prospective CUES participants will, particularly at the outset of the CUES Program, have time commitments attributable to curriculum requirements, teaching loads, job requirements, etc., that render participation in the Program difficult. Therefore, flexibility in the presentation of curriculum elements will be emphasized. Accordingly, implementation of curriculum elements in a form suitable for use in independent study will be required insofar as is feasible. Provision will be made as appropriate for validating attainment of performance objectives and for administering independent study activities.

3.4.3 The Product

The following sections describe items that the contractor will be required to deliver. In some instances, it is anticipated that existing materials will be adequate for use in the CUES Program; the source of these materials and the ways in which they will be acquired and used in conjunction with new materials produced by the contractor are topics that will be determined on an individual contract basis and appropriately reflected in the terms of the contract. Similarly, materials developed by contractors will be delivered in a number of copies and on a date as determined by contract.

3.4.3.1 Printed Materials. Examples of printed materials that a contractor would be expected to produce, generally on a curriculum unit basis, are as described below:

- o Textbooks and handouts for use as appropriate on the unit set, unit, or subunit levels.
- o Statements of prerequisites and unit summaries for use in determining the desirability of incorporating an existing unit into a course, and to aid in planning independent study activities.
- o Pre-tests for use in coordinating instruction with student needs, such as by eliminating redundant coverage of topics.
- o Criterion tests for use in measuring achievement of performance objectives following instruction.
- o Problem sets for instructional use.
- o Reference lists for use in obtaining outside information related to subject matter delivered by the contractor.
- o Study outlines for use in coordinating independent study and as orientation aids.
- o Glossaries defining technical terminology.
- o Teachers' manuals that discuss pedagogical methods and performance objectives.

3.4.3.2 Audio-Visual Materials. Contractors will be encouraged to consider a variety of media (e.g., film strips, slides, films ~ including animated types ~ to the extent that they may be economically feasible, television, etc.) for use as instructional aids, and to provide for the use of media that can be justified in terms of economy and proven contribution to learning achievement. Availability and cost of display or reproduction equipment and of subject matter will be factors in determining the applicability of a particular medium.

3.4.3.3 Computer Programs. Computer programs will be deliverable products where: (1) curriculum elements involve development of programs by students, or (2) programs are used in performing demonstrations for the benefit of students.

In general, teachers will be provided with examples of programs that students will be expected to write. These examples will consist of program listings and descriptions of the logic and algorithmic methods used, and will be intended for use in evaluating student achievement and in suggesting improvements.

Programs that are intended for use in demonstrations where the results of a single computer run would not be sufficient for presentation to different classes (e.g., when demonstrating how a program is presented to the computer and how the results are subsequently printed) will be supplied to teachers both in a form suitable for running upon the computer and with supporting documentation as required for examples of student programs.

3.4.4 Curriculum Element Implementation Sequence

In producing a given curriculum element, it is generally expected and will be suggested that contractors follow a definite sequence of steps such that quality control of the final product will be simplified. Progress, problems, major decisions, and other factors relating to the final product should be subject to review and criticism by a project

officer. A typical sequence might be as listed below, the actual sequence to be determined prior to undertaking work:

- o Analyze course objectives and content.
- o Survey and select existing curriculum material.
- o Design instructional methods of presentation.
- o Prepare performance objectives for, design, and sequence units.
- o Develop test material.
- o Prepare performance objectives for, design, and sequence subunits.
- o Prepare instructional material.
- o Tryout-evaluate-revise cycle(s).
- o Make final revisions.
- o Make final delivery.

3.5 IMPLEMENTATION OF THE CURRICULUM

It is recognized that implementation of the CUES curriculum poses difficult problems in terms of fitting new courses into existing curricula, fitting new units into existing courses, and scheduling teacher training. As described in Section 3.4.2.2, provision for independent study will be made where possible in order to at least alleviate the problem of implementation. The ultimate decision as to how best to implement the CUES curriculum will be made by participating schools. With respect to adding a new course, one or more of the following approaches could prove adequate:

- o Make the new course extracurricular, where classes meet on Saturday or after regular school hours.
- o Add the new course to the current course offering for choice as an elective.
- o Substitute the new course for an existing one.
- o Reduce the time devoted to several existing courses in order to add the new one.
- o Incorporate units of the new course into existing courses.

Section 4 THE CURRICULUM

4.1 GENERAL

Emphasis in the CUES curriculum will be placed upon elements to be presented to secondary school students. Therefore, Section 4 is exclusively concerned with secondary school curriculum elements except for Section 4.4, which considers the planned junior college offering as well.

Secondary school curriculum elements will be combined to form several distinct groups:

- o Elements intended to provide a background that will facilitate the use of a computer as a tool in various course disciplines at the secondary school and college levels (i.e., the "continuing group").
- o Elements that are designed to promote an understanding of how computers are used in a business environment (i.e., the "business group").
- o Elements that will aid the student in obtaining direct employment in the computer field (i.e., the "vocational group").
- o Elements that provide the student with conceptual understanding of computers (i.e., the "general group").

Sections 4.5 and 4.6 discuss the various groups. Because several introductory elements are common to the business, vocational, and general groups, these will be collectively referred to as the special groups.

It is expected that the interests of a given student may correspond to instruction offered in courses from more than one group. Further, it is recognized that the CUES curriculum will not necessarily coincide with a given school's existing course offerings. Accordingly, the modular structure of CUES curriculum elements will be such that the CUES curriculum can be used by schools different from one another in terms of course offerings. It is, therefore, anticipated that individual students as well as entire classes will be offered units outside the normal curriculum in order to cover topics of special interest.

The equivalent of 150 clock hours of classroom instruction is considered to be the length of a course. Two kinds of courses are planned for the CUES curriculum: (1) introductory courses that will be designed to provide students with a general background in the ways that computers work and how they are being used, and to teach students how to program computers; and (2) vocational courses designed to augment introductory courses in training students for computer related employment. It is planned to develop "A" and "B" versions of introductory course unit sets to correspond to differences in potential achievement levels among students. The "A" and "B" versions correspond loosely to the continuing curriculum element group and the special curriculum element groups, although the curriculum will be designed to facilitate presentation of a given element to all students exhibiting interest in the subject matter.

Application units are also planned for the CUES curriculum, these units to be incorporated into existing courses at the 11th grade, 12th grade, and junior college levels.

4.2 INTRODUCTORY COURSES

Introductory courses are planned for presentation to all 9th and 10th grade students participating in the CUES curriculum. These courses will consist of unit sets in fundamental computer concepts and in computer programming techniques, with units from each unit set to be presented alternately or otherwise intermixed as necessary to stimulate student interest and promote understanding. Although courses in fundamental concepts and in programming techniques could be presented individually in different years, it is believed that units from each of these unit sets can be incorporated into composite courses of greater value.

Computer programming techniques units to be included in the introductory courses offer an approach to problem solving that is applicable in non-computer disciplines. This approach is made evident by the following brief description of computer programming.*

The first step in the development of a computer program is the preparation of a textual or graphical expression of the method to be employed in arriving at a solution. The method is necessarily based upon a clear understanding of the problem to be solved. This step is referred to as analysis, and will require students to demonstrate logical thinking in order to plan a solution. Thus, analysis of problems will be given appropriate emphasis in the CUES introductory courses. In addition, the programming phases of the introductory courses will provide students with an opportunity to write computer programs and have them run on a computer. The computer will provide feedback to the student descriptive of the processing which has occurred. The student will then interpret the feedback and resubmit a corrected program for further processing, these tasks to be repeated until all errors have been eliminated. In the cycle of input-processing-output, the student will verify the correctness of his analysis, know and be able to use the computer programming language, have some knowledge of how the computer functions, and be able to interpret the computer output. The practical experience gained in this process will provide the student with experience in analyzing and solving problems of increasing difficulty and in using the computer as a tool to assist him in arriving at a solution.

*Computer programming can be summarized as consisting of the following typical activities:

- | | |
|---|---|
| 1. State the problem | 6. Write the program |
| 2. State any assumptions | 7. Test the program |
| 3. Specify the data input (if any) | 8. Use the program; process data input (if any) |
| 4. Specify the type of output desired | 9. Examine the final solution |
| 5. Specify the procedure to be followed in arriving at a solution | 10. Write a report |

Unit sets intended for inclusion in the introductory courses will be entitled, respectively:

- o Fundamental Concepts in Our Contemporary World
- o FORTRAN Programming Techniques
- o COBOL Programming Techniques

4.2.1 Fundamental Concepts

This unit set will be developed in "A" and "B"* versions that differ primarily in depth and will have the following characteristics:

- o Overall Purpose: to provide students with a basic understanding of the capabilities and limitations of computers.
- o Intended Audience: 9th and 10th grade students.
- o Length of Unit Set: 150 clock hours.
- o Prerequisites: prior or concurrent exposure to first year algebra is desirable.
- o Overall Performance Objectives: students will be able to summarize the general organization of computer hardware and software, how a computer system works, and how computers are currently being used.

4.2.2 FORTRAN Programming Techniques

This unit set will be developed in "A" and "B"* versions that differ in length, content, and depth, and will have the following characteristics:

- o Overall Purpose: to instruct students in problem solving techniques and in computer programming using a widely accepted language.
- o Intended Audience: 9th and 10th grade students.
- o Length of Unit Set: 150 clock hours for the "A" version, 100 clock hours for the "B" version.
- o Prerequisites: prior or concurrent exposure to first year algebra is desirable.
- o Overall Performance Objectives: starting with a problem statement, students will be able to arrive at a solution by developing and correctly running a computer program written in the FORTRAN language.

*"A" and "B" curriculum element versions are intended for presentation to college-oriented and vocationally-oriented students, respectively, although the "B" version may attract college-oriented students who plan to seek computer-related employment on a part- or full-time basis.

4.2.3 COBOL Programming Techniques

This unit set will have the following characteristics:

- o Overall Purpose: to instruct students in computer programming using a language widely used in solving business-type problems.
- o Intended Audience: 9th or 10th grade students*.
- o Length of Unit Set: 50 clock hours.
- o Prerequisites: the "A" or "B" versions of FORTRAN Programming Techniques; prior or concurrent exposure to first year algebra is desirable.
- o Overall Performance Objectives: starting with a problem statement, students will be able to arrive at a solution by developing and correctly running a computer program written in the COBOL language.

4.3 VOCATIONAL COURSES

Vocational courses will be offered during the 11th and/or 12th grades to students who have completed the introductory courses and are interested in seeking employment in the computer field. These courses will provide students with a competitive advantage over untrained job applicants, assuming similar degrees of aptitude. The advantage can be measured in terms of reduced formal or on-the-job training requirements in order for the student to perform one of a variety of computer-related jobs, such as coder or computer programmer. The term "programmer-aid training" is used to designate the vocational training to be offered in the CUES curriculum. It should be noted that most computer programming jobs are filled by persons who have bachelor-level college degrees, and that some programmer jobs are filled by (and, indeed, some require) persons with graduate study and perhaps with advanced degrees. There are, nevertheless, interesting and useful programming jobs that can be performed by individuals with no more than high school educations, or by college students working on a part-time basis.

*The COBOL Programming Techniques unit set will also be suitable for presentation to 11th and 12th grade students as part of an existing course typically selected by students that have completed the "A" version introductory courses (it is expected that students enrolled in the "B" version introductory courses will have completed COBOL Programming Techniques in the 10th grade, as shown in Section 4.6). Consequently, this unit set will include some problems which are more challenging than those intended for assignment to 9th and 10th grade students.

Unit sets that will be presented as vocational courses in the CUES curriculum will be entitled, respectively:

- o Scientific Programmer-Aid Applications Course
- o Business Programmer-Aid Applications Course

4.3.1 Scientific Programmer-Aid Applications Course

This unit set will have the following characteristics:

- o Overall Purpose: to help qualify students for computer-related employment in a technical environment.
- o Intended Audience: 11th or 12th grade students.
- o Length of Unit Set: 150 clock hours.
- o Prerequisites: first and second year algebra, and the "A" or "B" versions of both Fundamental Concepts and FORTRAN Programming Techniques; prior or concurrent exposure to additional courses in mathematics and the sciences is desirable.
- o Overall Performance Objectives: starting with a problem statement, as might be produced by a scientist or engineer, reduced to the point where only a knowledge of elementary mathematics is required, students will be able to arrive at a solution by developing and correctly running a computer program written in the FORTRAN language.

4.3.2 Business Programmer-Aid Applications Course

- o Overall Purpose: to help qualify students for computer-related employment in a business environment.
- o Intended Audience: 11th or 12th grade students.
- o Length of Unit Set: 150 clock hours.
- o Prerequisites: first year algebra, business arithmetic, the "A" or "B" versions of both Fundamental Concepts and FORTRAN Programming Techniques, and COBOL Programming Techniques.
- o Overall Performance Objectives: starting with the statement of a business or logical problem reduced to the point where only a knowledge of elementary mathematics and/or business arithmetic is required, students will be able to arrive at a solution by developing and correctly running a computer program written in the COBOL language.

4.4 APPLICATION UNITS

The CUES curriculum will include computer-oriented application units to be designed for incorporation into courses currently offered in the non-computer disciplines. Application units would be used as follows:

- o A student would write a computer program to solve a problem arising in a particular discipline.
- o In cases where development of a computer program by a student would be impractical, a student would supply parameters to an existing program capable of solving a problem arising in a particular discipline.
- o A teacher would either write a program or use an existing program to solve a problem relating to a discipline, the purpose being to either produce results for presentation to different classes or to solve a problem of interest arising in a particular class.

The plan for CUES curriculum development calls for implementation of a comprehensive core of application units to be made available to teachers in the various disciplines. It is anticipated that teachers will draw upon existing application units, increasingly so with experience, as the benefits in terms of improved achievement and time savings become apparent. It is also anticipated that teachers will augment the collection of application units as they gain the necessary computer experience, the incentives being: to associate applications with individual teaching needs, to improve teaching effectiveness, and to correlate application units with both existing and new subject matter.

Appendix B itemizes application units to be developed for use in the CUES curriculum. In summary, units will be developed for use in the following 11th and 12th grade courses:

- o Mathematics
- o Physics
- o Chemistry
- o Biology
- o The Social Sciences
- o Business courses

In addition, units dealing with special topics (statistics, for example) will be developed for use in such courses as history, music, literature; or for use in relation to the physical education program and the library.

Only application units will be presented at the junior college level. These units will be limited to business and the social sciences, and will be directed to students who have: (1) successfully completed the CUES secondary school curriculum elements, (2) completed similar computer-oriented courses in schools that are not involved in the CUES Program, or (3) obtained the necessary background by means of independent study.

4.5 CONTINUING CURRICULUM ELEMENT GROUP

Elements of the CUES curriculum that are expected to be presented as the continuing group are as follows:

- 9th grade: the first introductory course, to consist of one-half (75 clock hours) each of the version "A" Fundamental Concepts and FORTRAN Programming Techniques unit sets.
- 10th grade: the second introductory course, to consist of the remaining halves (75 clock hours each) of the version "A" Fundamental Concepts and FORTRAN Programming Techniques unit sets.
- 11th and 12th grades: application units in the various sciences.

4.6 SPECIAL CURRICULUM ELEMENT GROUPS

Three special curriculum element groups are planned for inclusion in CUES: the business group, the vocational group, and the general group. These groups will be constructed of elements as shown below:

- 9th grade (business, vocational, and general): the first introductory course, to consist of units from the version "B" Fundamental Concepts (75 clock hours) and FORTRAN Programming Techniques (75 clock hours) unit sets.

10th grade (business and vocational): the second introductory course, to consist of the remaining units from the version "B" Fundamental Concepts (75 clock hours) and FORTRAN Programming Techniques (25 clock hours) unit sets, in addition to the COBOL Programming Techniques unit set (50 clock hours).

10th grade (general): a course composed of the COBOL Programming Techniques unit set (50 clock hours), and an additional 25 clock hours of application units, probably drawn from the business collection.

11th and 12th grades (business): various business application units.

11th and/or 12th grades (vocational): one or both of the Programmer-Aid Training Courses.

Section 5

TEACHER AND ADMINISTRATOR TRAINING COURSES

5.1 GENERAL

Training courses for teachers and administrators will be developed and presented as parts of the CUES Program.

5.2 THE TEACHER TRAINING COURSE

In order to prepare teachers for their individual roles in the CUES Program, a flexible training course will be developed. This course will be designed to meet the requirements of an intended audience that is heterogeneous with respect to anticipated degree of participation in CUES. For example, some members of the audience will be preparing to teach CUES courses, others will be preparing to use application units, and still others will be preparing to do both.

The course will be composed of units similar to those presented in the various CUES curriculum elements described in Section 4. The major differences in presenting introductory material will be that the overall presentation will be accelerated and teaching aspects will be stressed.

The general aspects of application units will be presented to the entire audience. It is anticipated that application units dealing with detailed subject matter in the various disciplines will be presented to groups of teachers having similar teaching requirements.

It is planned to develop teacher-oriented administrative-support capabilities for use in conjunction with the CUES computer system. Provision will be made for instructing teachers in the use of these capabilities. However, because some of the teachers expected to use these capabilities may not otherwise be involved in CUES, administrative-support training will be developed in units that can be presented either as part of the teacher training course or independently.

In summary, the Teacher Training Course will be as described below:

- o Overall Purpose: to prepare teachers for participation in the CUES curriculum.
- o Intended Audience: teachers expected to conduct classes in which CUES course and/or application unit material will be presented.
- o Length of Unit Set: to be determined when detailed specifications are prepared.
- o Prerequisites: none.
- o Overall Performance Objectives: teachers will be able to present the appropriate CUES subject matter, discuss related aspects of CUES, use demonstration computer programs, and write computer programs in the FORTRAN and COBOL languages.

5.3 THE ADMINISTRATOR TRAINING COURSE

A training course will be developed for presentation to school administrators or others concerned with the use of an administrative-support facility. This facility will be composed of computer programs developed for use in conjunction with the CUES computer system, the development effort to be a part of the CUES Program. Examples of applications for the administrative-support facility would include payroll preparation and class scheduling, although precise requirements of the facility have not yet been specified.

In summary, the Administrator Training Course is expected to be as described below:

- o Overall Purpose: to train those concerned with tasks related to school administration in the use of the administrative-support system.
- o Intended Audience: administrators and other appropriate school employees.
- o Length of Unit Set: 30 clock hours.
- o Prerequisites: none.
- o Overall Performance Objectives: those completing the course will be able to use elements of the administrative-support facility.

APPENDIX A

OVERVIEW OF CUES

A-1 PURPOSE

The U. S. Office of Education, through its Bureau of Research Division, has established a program for secondary schools and junior colleges (grades 9-14) called the Computer Utility for Educational Systems (CUES) with the following objectives:

1. To familiarize large numbers of students with fundamental computing concepts and modern information processing techniques. Computers are now in wide-spread use in our highly technical society. It is therefore important that the individual have an accurate basic understanding of the general capabilities of computers, and of the roles that computers play in relation to the individual.
2. To provide students with an introduction to computer programming and problem solving with the aid of a computer. For college-bound students and junior college students, the Program will provide a limited capability to use a new tool that should both assist them in their further studies and improve their understanding of the ways in which the computer has broadened their problem-solving horizons. For students whose formal education may terminate prior to or upon graduation from the secondary school, the Program will provide a limited exposure to one of several job specialities in the computer occupational field. This exposure will help to qualify some students for employment as technicians, or as aides to professional workers in the computer field.

3. To provide students and teachers with a computing capability for demonstrations and for solution of problems in various academic subject areas.

4. To provide a computer capability for performance of a wide variety of administrative tasks such as student record-keeping and accounting, budgetary functions, employee accounting, equipment and facilities accounting, and miscellaneous auxiliary services.

5. To provide school administrators and school governing bodies with a readily accessible source of information to assist them in determining the computer support needed and the cost of obtaining it for their respective school systems. Using this information, better planning for requirements and associated costs should be possible.

6. To provide for the analysis and design of a computing system which is adequate to meet the current requirements of the participating school systems, and with growth capability to meet increased demands in the future with a minimum of disruption and reprogramming.

7. To determine the feasibility and the economic parameters of providing computing capability in support of the instructional programs of individual schools through the use of remote terminals linked via communications lines to a large central computer.

8. To provide the curriculum materials, hardware, software, and administrative support which together constitute a Pilot system, or working model, which will serve to demonstrate the feasibility of achieving these stated objectives.

9. To encourage private enterprise, on its own initiative and with its own capital, to seek the cooperation of school districts and junior colleges in other geographical regions to replicate the Pilot System. It has been estimated that thirty strategically located centers similar to that envisioned for CUES could bring the CUES instructional and administrative program to most of the nation's secondary school population.

Students will benefit from the above objectives by way of curriculum elements to be developed as a part of the CUES Program. These elements will provide for instruction in the ways computers are currently being used to solve problems and perform services, and will also provide for computer utilization by students in solving practical problems.

Administrators and teachers will benefit from the above objectives in that CUES will include an administrative support system. This support system will include automated and semi-automated aids designed to simplify the performance of administrative tasks. Both administrators and teachers will be trained in the use of appropriate components of the support system. In addition, teachers will be trained for subsequent presentation of computer-related topics, and in the use of the computing facility as a teaching aid. Training courses for administrators and teachers will be developed as a part of the CUES Program.

A-2 ADMINISTRATIVE SUPPORT SYSTEM

A computer-based administrative support system is planned as a CUES component. It is recognized that in order to be competitive with existing alternatives, the administrative support system must compare favorably in terms of cost (both development and usage), quality of service, and overall convenience.

Existing support systems are aiding administrators in the management of day-to-day operations, and in the development of plans for meeting future requirements. Support systems are aiding teachers in such areas as report card preparation, attendance record keeping, and test scoring.

The basis exists, then, for development of an administrative support system for CUES that will offer significant benefits to administrators and teachers, in addition to benefits offered students through the CUES curriculum.

Elements of the support system will be so determined as to maximize responsiveness to the needs of its users, both administrators and teachers. Accordingly, it will be the preferred CUES policy that the ultimate users take part in the selection of elements that are commensurate with actual requirements. The value of user participation in determining capabilities and appearance (to a user) of the support system is considered to be most significant.

It is anticipated that the basis for the CUES administrative support system will be supplied, in the form of a business-oriented management information system, by the vendor selected to supply a computer and executive system software for use in CUES. In addition, it is probable that some software designed specifically for use in educational administration will also be supplied by the vendor. Development of additional elements of the support system will be undertaken as necessary to provide a comprehensive support capability.

The support system is expected to include such automated or semi-automated elements as the following: a teacher personnel and payroll subsystem, a class scheduling subsystem, an appropriations/budget forecast subsystem, a school/district accounting subsystem, a teacher retirement subsystem, a grade recording/reporting subsystem, etc.

A-3 THE COMPUTER UTILITY

The CUES Pilot System will be established in a metropolitan area approximately 100 miles in radius. It will include a computing system capable of servicing the information processing requirements of 100 schools within this area with a total student population of 200,000.

The computing system will consist of a large-scale central computer that is linked to a large number of remote terminals by means of voice grade communications lines. The central computer, to be located at the "Data Center," will include a high-speed card reader, a high-speed printer, and various other peripheral equipment. Three types of remote terminals will be included in the computing system: medium-speed card readers, medium-speed printers, and a few typewriter terminals. A pair of remote terminals, to consist of one medium-speed card reader and one medium-speed printer, will be considered to be a single "remote station." Jobs may be submitted for processing either through remote terminals or by courier delivery to the Data Center.

Initially, there will be one remote station at each school. As the Program progresses, it is anticipated that each school with an enrollment in excess of 2,000 students may require an additional remote station. Thus, the initial requirement will be for 100 input and 100 output communications lines to the Data Center with an eventual growth to approximately 114 of each.

Student jobs, including programs and data, will be input to the Data Center via the remote station card readers. Printed output will be returned to the remote station printers. From the time a student job is read to the time final results are printed, all processing will take place automatically, and all transmission between a remote station and the Data Center will take place via communications lines.

In addition to student jobs, a class of jobs known as "administrative queries" will also be input to the Data Center via remote station card readers. Depending upon the priority and output volume of a given administrative query, its printed output will be either produced on the appropriate remote station (medium-speed) printer or produced on the Data Center (high-speed) printer and returned to the remote station site by courier.

Administrative jobs other than administrative queries, particularly those with large input and/or output volumes, will be both submitted to and returned from the Data Center by courier. High-speed input/output devices will be used to run this class of administrative jobs.

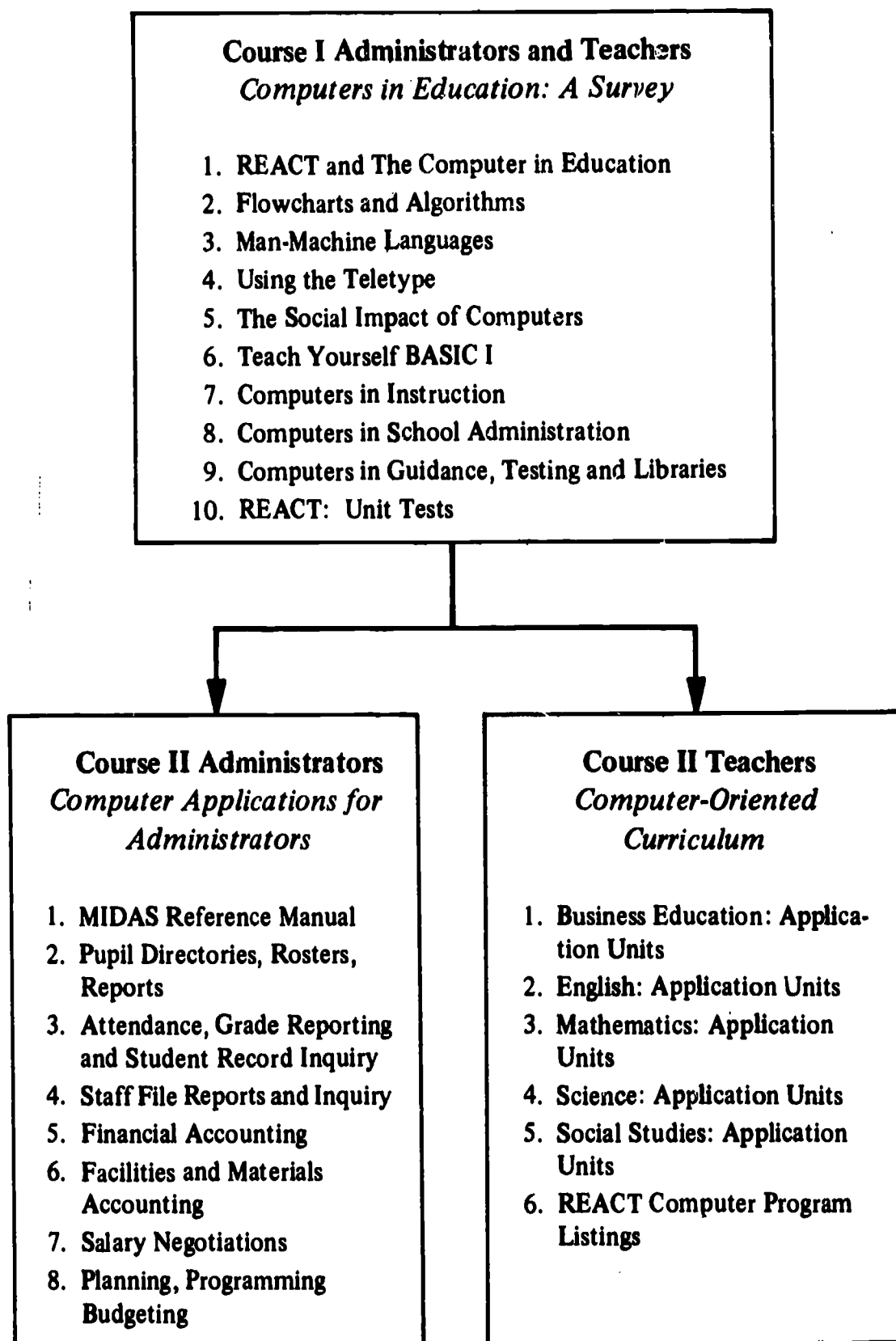
APPENDIX BLIST OF SPECIFICATION DOCUMENTS FOR ELEMENTS
OF THE CUES CURRICULUM

1. Development of 9th and 10th Year Unit Sets in Fundamental Computer Concepts in Two Versions
2. Development of 9th and 10th Year Unit Sets in FORTRAN Programming Techniques in Two Versions
3. Development of the 11th through 12th Year Application Unit in Mathematics
4. Development of the 11th and 12th Year Application Unit in Physics
5. Development of the 11th and 12th Year Application Unit in Chemistry
6. Development of 11th through 12th Year Application Unit in Biology
7. Development of 11th through 12th Year Application Unit in Social Science
8. Development of 11th through 12th Year Application Unit in Special Topics
9. Development of the 11th or 12th Year Scientific Applications Course for the Scientific Programmer-Aid
10. Development of the 13th through 14th Year Application Unit in FORTRAN related to Economics, Psychology, and Sociology
11. Development of 11th through 12th Year Application Unit in Business Arithmetic
12. Development of 11th through 12th Year Application Unit in Accounting
13. Development of 11th through 12th Year Application Unit in Business Economics
14. Development of 11th through 12th Year Application Unit in Merchandising
15. Development of the 11th or 12th Year Course for the Business Programmer-Aid
16. Development of the 13th through 14th Year Application Unit in COBOL related to Business Data Processing
17. Development of the 10th Year Unit Set in COBOL Programming Techniques for Terminal Students
18. Development of a Teacher Training Course
19. Development of a School Administrator Course

APPENDIX B

DESCRIPTION OF COURSE

REACT COURSE MAP



COURSE I: ADMINISTRATORS AND TEACHERS

Computers in Education: A Survey

Course Length: 30 Hours

Prerequisites: None

This course provides administrators, teachers, curriculum specialists and undergraduate and graduate educational majors an introductory familiarization with computers. Through the study of elementary computer concepts and the role of the computer, the educational uses of computers are presented in a broad context. The teachers and administrators develop an understanding of:

- **Concepts of computer components, input-output, storage and differences in computer types, generations, sizes, and speeds.**
- **How man communicates his problem to the computer for solutions through different types and levels of programming.**
- **The concepts of mini-computers and time-sharing, the use of the teletypes for on-line introduction and elementary BASIC programming.**
- **The potential impact of the computer on society, separating the realities from the myths.**

Teachers and administrators are introduced to the fields of educational computing and prepared for intensive study of classroom uses or administrative use of the computer through presentation of the over-view of the field. Understanding is developed for the potential of computer use in classroom problem solving, vocational training, computer-assisted instruction, simulation, library management, guidance and training, curriculum management, and integrated data management systems. Instructional mode will be classroom presentation and "hands-on" experience with individualized instruction.



COURSE FLOW: Computers In Education: A Survey

These books are the texts for the introductory course in computers in education. Each of the books utilizing individual programs as demonstration tools contains the computer program run for its particular exercise.

REACT and the Computer in Education

Provides an over-view of the course of study for teacher and administrator, as well as serving as a general introduction to computers. Covers briefly the functions of a computer system and its hardware and software components.

Flowcharts and Algorithms

Explores problem-solving techniques with particular emphasis on the algorithmic approach and flowcharting. Should be considered a prerequisite to programming units.

Man-Machine Languages

Introduces computer programming using a simple simulated computer. Topics include the nature of man-machine communication, and characteristics of machine-level and high-level languages.

Using the Teletype



Instructs the reader in the use of the teletype by a progression of "hands-on" steps at the keyboard.

The Social Impact of Computers



Attention is given to present and potential impact of computers on society. Areas of creativity, privacy of information in a retrieval system, and the "computer utility" explored through computer program.

Teach Yourself BASIC I



Using a terminal connected to a time-sharing system the user is guided through a series of exercises designed to allow him to learn to program BASIC.

Computers in Instruction



Covers the areas of instruction about computers, problem-solving, simulation, computer-managed instruction and computer-assisted instruction.

Computers in School Administration



Discusses the range of applications commonly automated in the field of school administrations. An on-line salary negotiation program is presented as an example of an administrative planning tool.

Computers in Guidance, Testing and Libraries

Describes several systems which have been developed in the areas of guidance, college selection, test analysis, and library administration.

REACT: Unit Tests

Contains multiple choice examination questions and answers for each of the units listed above. Tests are suitable for pre-tests and/or post-tests.

COMPUTERS IN EDUCATION: A SURVEY

REACT and the Computer in Education

COURSE II: ADMINISTRATORS

Computer Applications/Administrators

Course Length: 30 Hours

Prerequisites: Computers in Education: A Survey; or Equivalent with Instructor's Approval

The course will utilize a demonstration data management system in a "hands-on" environment to explore a variety of fundamental administrative data processing concepts. A system is constructed for a model school in order to examine major application areas. The applications range from the routine (preparation of report cards) to the imaginative (a program planning budgeting system). General topics of study include:

- Recognition of an effective computer application.
- Traditional educational administrative applications as implemented on a computer.
- The computer as a decision making and planning tool for school administrators.
- Basic computer functions as applied to educational applications.
- Opportunities and problems presented by a computer.
- State of the art.

The administrator will have a broad picture of the types of tasks within a school district that are best suited to a computer and an appreciation for what is involved in implementation. Implications from a management standpoint will be discussed. Specific areas of interest of individual participants will be addressed as time allows. The course is presented in a classroom and workshop environment.



COURSE FLOW: Computer Applications/Administrators

The set presents various administrative applications at individual school level, district office level, and top decision-making level. It is also organized to reflect increasingly complex data processing techniques. MIDAS, a demonstration data retrieval system, is the vehicle for working sample problems.

MIDAS Reference Manual

MIDAS is a demonstration data retrieval system which is used as the vehicle to solve sample problems. This guide to the use of MIDAS is a reference tool and is meant to accompany the other manuals in the course.

Pupil Directories, Rosters, Reports

Describes contents, creation and utilization of data files in the area of pupil personnel. Files are used to demonstrate basic reporting functions at the building level.

Attendance, Grade Reporting and Student Record Inquiry

Demonstrates more extensive reporting functions in pupil personnel accounting, such as attendance and grade reporting. Also explores techniques for interacting with the system to extract individual student data.

Staff File Reports and Inquiry

Staff data is used for a variety of personnel reports, excluding payroll. Problems also include inquiry into individual staff records for decision-making and planning purposes.

Financial Accounting

Applications include payroll and expenditure accounting. Shows how basic accounting concepts lend themselves to computer solution. Fundamentals of program accounting are introduced.

Facilities and Materials Accounting

Deals with systems of inventory, accounting, and identification of physical facilities and resources within a school district. Items range from curriculum materials to buildings.

Salary Negotiations

Uses a simulation program to allow the administrator to manipulate parameters in order to explore the effects of various salary schedules. Used to determine comparative costs and cost distribution as a result of salary negotiations.

Planning, Programming, Budgeting

This manual demonstrates the use of simulated data from several files to solve a curriculum problem. Implications for budget planning and administrative decision-making are drawn from this exercise.

COURSE II: TEACHERS

Computer-Oriented Curriculum

Course Length: 30 Hours

Prerequisites: Computers in Education: A Survey; or Equivalent with Instructor's Approval

The course offers a complete description of application units available in Social Studies, English, Business, Sciences, and Mathematics. This includes a comprehensive review of the resource materials currently available. Materials augment present course outlines; that is, the program supplements and enriches existing learning and teaching methods — it requires no change in curriculum. Curriculum is extended because of increased efficiency and capabilities inherent in computer use. Each application unit from the various subject areas includes:

- A description of the computer program.
- A rationale for the unit.
- Suggestions for several ways the unit could be integrated with the on-going curriculum.
- Objectives describing the desired student performance after each unit.
- Required preparation for students planning to use the unit.
- Directions for further study and exploration of the concept.
- A complete computer program run.

Emphasis will also be given to student-oriented materials, laboratory and demonstration techniques and inter-disciplinary approaches. In addition, the course will include a continuation of the elementary BASIC instruction offered in Course I. Instruction will be completely individualized and tailored to meet the specific requirements of each participating teacher or staff member. This class is offered in a workshop environment.



COURSE FLOW: Computer Oriented Curriculum

This series contains programs demonstrating the computer as a classroom instructional tool in various disciplines. Instructions for running the programs as well as suggested uses are included.

Business Education: Application Units

Specific applications are: Annuities, Loans, Mortgages, Savings, Retail Discount, Compound Interest Rates, Installment Loans.

English: Application Units

In order to demonstrate the power of the computer as a processor of alphabetic symbols as well as numeric symbols, the book utilizes a program for the study of structure and meaning in poetry.

Mathematics: Application Units

Some representative applications include: Properties of Operation, Quadratic Formula, Law of Sines, Functions and their Graphs, Graphs of Linear Equations.

Science: Application Units

Working within the fields of Biology, Physics and Chemistry the programs demonstrate the role of the computer in calculation, statistical analysis, simulation, and generation of laboratory data.

Social Studies: Application Units

Programs demonstrate the assistance of computers in decision-making, simulation, and storage use and manipulation of large volumes of data as applied to the social sciences.

REACT Computer Program Listings

Contains program listings for all of the computer programs used in the Application Units manuals. Included among these are the programs that are also used in the series for Course I.

APPENDIX C

SALES BROCHURE

Staff Development Program for Teachers and Administrators in the use of computers for instructional purposes.

REACT Relevant Educational Applications of

The ever increasing use of computers for school administrative and instructional programs poses a continuing challenge for educators. School personnel and students need an intelligent understanding of the computer and its advantages in order to best utilize its potential. Recognition of this need has brought about REACT: Relevant Educational Applications of Computer Technology.

Developed by the Northwest Regional Educational Laboratory, under the direction of the U.S.O.E., REACT instructional courses emphasize computer applications and provide "hands-on" experience.

These special training courses are organized into separate modules for school administrators and teachers.

Each course utilizes a series of publications developed by the REACT program. The manuals are also available individually or in course sets for use as texts in a university education curriculum, or for individuals who wish to use them in a self-study setting.

REACT training courses are designed for:

- Structured seminars and workshops as offered by Tecnica.
- University departments of education
- Individual self-study.
- Independent reference materials.

Tecnica Education Corporation offers these courses as in-service training as outlined in the course descriptions.

I Administrators and Teachers

COMPUTERS IN EDUCATION: A SURVEY

Course Length: 30 Hours

Prerequisites: None

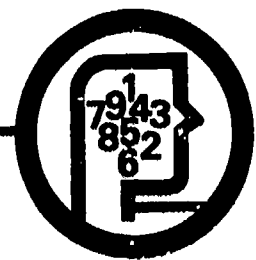
Materials Required: Included with Course

Maximum Enrollment: 25

This course provides administrators, teachers, curriculum specialists and undergraduate and graduate educational majors an introductory familiarization with computers. Through the study of elementary computer concepts and the role of the computer, the educational uses of computers are presented in a broad context. The teachers and administrators develop an understanding of:

- Concepts of computer components, input-output, storage and differences in computer types, generations, sizes and speeds.
- How man communicates his problem to the computer for solutions through different types and levels of programming.
- The concepts of mini-computers and time-sharing, the use of the teletypes for on-line introduction and elementary BASIC programming.
- The potential impact of the computer on society, separating the realities from the myths.

Teachers and administrators are introduced to the fields of educational computing and prepared for intensive study of classroom uses or administrative use of the computer through presentation of the over-view of the field. Understanding is developed for the potential of computer use in classroom problem solving, vocational training, computer-assisted instruction, simulation, library management, guidance and training, curriculum management and integrated data management systems. Classroom presentation and "hands-on" experience with individualized instruction.



I Administrators

COMPUTER APPLICATIONS/ADMINISTRATORS

Course Length: 30 Hours

Prerequisites: Computers in Education: A Survey;
or Equivalent with Instructor's Ap-
proval

Materials Required: Included with Course

Maximum Enrollment: 16

The course will utilize a demonstration data management system in a "hands-on" environment to explore a variety of fundamental administrative data processing concepts. A system is constructed for a model school in order to examine major application areas. The applications range from the routine (preparation of report cards) to the imaginative (a program planning budgeting system). General topics of study include:

- Recognition of an effective computer application.
- Traditional educational administrative applications as implemented on a computer.
- The computer as a decision making and planning tool for school administrators.
- Basic computer functions as applied to educational applications.
- Opportunities and problems presented by a computer.
- State of the art.

The administrator will have a broad picture of the types of tasks within a school district that are best suited to a computer and an appreciation for what is involved in implementation. Implications from a management standpoint will be discussed. Specific areas of interest of individual participants will be addressed as time allows. Classroom and workshop environment.

I Teachers

COMPUTER-ORIENTED CURRICULUM

Course Length: 30 Hours

Prerequisites: Computers in Education: A Survey;
or Equivalent with Instructor's Ap-
proval

Materials Required: Included with Course

Maximum Enrollment: 16

The course offers a complete description of application units available in Social Studies, English, Business, Sciences and Mathematics. This includes a comprehensive review of the resource materials currently available. Materials augment present course outlines; that is, the program supplements and enriches existing learning and teaching methods — it requires no change in curriculum. Curriculum is extended because of increased efficiency and capabilities inherent in computer use. Each application unit from the various subject areas includes:

- A description of the computer program.
- A rationale for the unit.
- Suggestions for several ways the unit could be integrated with the on-going curriculum.
- Objectives describing the desired student performance after each unit.
- Required preparation for students planning to use the unit.
- Directions for further study and exploration of the concept.
- A complete computer program run.

Emphasis will also be given to student-oriented materials, laboratory and demonstration techniques and interdisciplinary approaches. In addition, the course will include a continuation of the elementary BASIC instruction offered in Course I. Instruction will be completely individualized and tailored to meet the specific requirements of each participating teacher or staff member. Workshop environment.

Tecnica/REACT Library



The REACT library is composed of the texts from the three training courses as designated below. The manuals are available individually or in course sets. Each of the books utilizing individual computer programs as demonstration tools contains the computer program run for its particular exercise.

COURSE I (Administrators and Teachers)

1. REACT and the Computer in Education \$1.65
Provides an over-view of the course of study for teacher and administrator, as well as serving as a general introduction to computers. Covers briefly the functions of a computer system and its hardware and software components.

2. Flowcharts and Algorithms \$1.65
Explores problem-solving techniques with particular emphasis on the algorithmic approach and flowcharting. Should be considered a prerequisite to programming units.

3. Man-Machine Languages \$1.65
Introduces computer programming using a simple simulated computer. Topics include the nature of man-machine communication, and characteristics of machine-level and high-level languages.

4. Using the Teletype \$1.65
Instructs the reader in the use of the teletype by a progression of "hands-on" steps at the keyboard.

5. The Social Impact of Computers \$1.65
Attention is given to present and potential impact of computers on society. Areas of creativity, privacy of information in a retrieval system and the "computer utility" explored through computer programs.

6. Teach Yourself BASIC I \$1.50
Using a terminal connected to a time-sharing system the user is guided through a series of exercises designed to allow him to learn to program BASIC.

7. Computers in Instruction \$1.65
Covers the areas of instruction about computers, problem-solving, simulation, computer-managed instruction and computer-assisted instruction.

8. Computers in School Administration \$1.65
Discusses the range of applications commonly automated in the field of school administrations. An on-line salary negotiation program is presented as an example of an administrative planning tool.

9. Computers in Guidance, Testing and Libraries \$1.65
Describes several systems which have been developed in the areas of guidance, college selection, test analysis and library administration.

10. REACT: Unit Tests \$1.65
Contains multiple choice examination questions and answers for each of the units listed above. Tests are suitable for pre-tests and/or post-tests.

All of the listings for Course I are contained in Book 6 (Course II for teachers), "REACT: Computer Program Listings".

COURSE II (Administrators)

1. MIDAS Reference Manual \$1.65
MIDAS is a demonstration data retrieval system which is used as the vehicle to solve sample problems. This guide to the use of MIDAS is a reference tool and is meant to accompany the other manuals in this course.

2. Pupil Directories, Rosters, Reports \$1.65
Describes contents, creation and utilization of data files in the area of pupil personnel. Files are used to demonstrate basic reporting functions at the building level.

3. Attendance, Grade Reporting and Student Record Inquiry \$1.65
Demonstrates more extensive reporting functions in pupil personnel accounting, such as attendance and grade reporting. Also explores techniques for interacting with the system to extract individual student data.

4. Staff File Reports and Inquiry \$1.65
Staff data is used for a variety of personnel reports, excluding payroll. Problems also include inquiry into individual staff records for decision-making and planning purposes.

5. Financial Accounting \$1.65
Applications include payroll and expenditure accounting. Shows how basic accounting concepts lend themselves to computer solution. Fundamentals of program accounting are introduced.

6. Facilities and Materials Accounting \$1.65
Deals with systems of inventory, accounting and identification of physical facilities and resources within a school district. Items range from curriculum materials to buildings.

7. Salary Negotiations \$1.65
Uses a simulation program to allow the administrator to manipulate parameters in order to explore the effects of various salary schedules. Used to determine comparative costs and cost distribution as a result of salary negotiation.

8. Planning, Programming, Budgeting \$1.65
This manual demonstrates the use of simulated data from several files to solve a curriculum problem. Implications for budget planning and administrative decision-making are drawn from this exercise.

Course II (Teachers)

1. Business Education: Application Units \$1.65
Specific applications are: Annuities, Loans, Mortgages, Savings, Retail Discount, Compound Interest Rates, Installment Loans.

2. English: Application Units \$1.65
In order to demonstrate the power of the computer as a processor of alphabetic symbols as well as numeric symbols, the book utilizes a program for the study of structure and meaning in poetry.

3. Mathematics: Application Units \$2.45
Some representative applications include: Properties of Operations, Quadratic Formula, Law of Sines, Functions and their Graphs, Graphs of Linear Equations.

4. Science: Application Units \$1.65
Working within the fields of Biology, Physics and Chemistry the programs demonstrate the role of the computer in calculation, statistical analysis, simulation and generation of laboratory data.

5. Social Studies: Application Units \$1.65
Programs demonstrate the assistance of computers in decision-making, simulation, and storage use and manipulation of large volumes of data as applied to the social sciences.

6. REACT Computer Program Listings \$2.45
Contains program listings for all of the computer programs used in the Application Units manuals. Included among these are the programs that are also used in the series for Course I.

*Prices apply to students, educators and educational institutions only. FOB San Carlos, California, plus tax. Orders for less than \$15.00 must be accompanied by remittance, or school purchase order.

APPENDIX D

SAMPLE UNITS

THE COMPUTER UTILITY

One of the reasons the social studies curriculum thus far has done very little in attempting to prepare students for the massive future impact of computer technology is the lack of concrete and realistic frameworks within which students can study the social implications of the computer. The program described in this unit provides one such framework. Today's student will undoubtedly be living most of their adult lives using the computer as a routine appliance both at home and at work. The transactions allowed by the program in this unit are not at all unrealistic and in fact are rather modest. Computer consoles in the home linked by phone lines to central computers someday will help the householder to do such things as:

1. Compute his income tax
2. Decide which of several home loans is the best
3. Maintain files of important personal information
4. Keep records of important dates; the computer could type out reminders each morning of important events for that day
5. Plan balanced menus for the family
6. Continue his formal education or allow his children to take courses for credit outside of school by accessing stored computer aided instruction programs
7. Access public information files; for example, he will be able to obtain the latest news reports or a list of the published books which deal with a particular subject

These are but a few of the possible future applications of the computer in the home. The critical issues which the social studies curriculum must begin to deal with, however, are not so much these particular applications of the computer, but rather the unprecedented social and moral questions which man faces as the computer becomes more influential in his life. The computer utility program of this unit highlights several of these critical issues: for example, the effect of the computer on the kinds of jobs that will be in demand; the question of who will and should have access to the personal information that will be stored in the computer; the ways in which the computer can change the types and quality of relationships that exist between people in our society; the question of who should make the decisions about whether and in what form information about people will become centralized in a computer, and so forth.

THE COMPUTER PROGRAM

The computer program in this unit is an elementary model of a computer based utility system. It has been designed to demonstrate some of the ways in which a computer system of the not too distant future might be able to help man facilitate many of the activities which involve close coordination among various members of society. This particular program demonstrates such a use of the computer with respect to some of the common financial activities which take place among households, retail businesses and banks. The program permits you to play the role of either a householder, a retail merchant or a banker.

The computer recognizes which of the roles you have chosen by the utility number you enter into the machine. If the utility number is one which is allowed to use the system, the computer will offer you the following choices:

1. If the user has entered the number of a householder he can:
 - a. Place a purchase order with a retail business to which he has access. Before ordering, the householder can examine the current inventory file of the firm and the retail price of each item. Once an order is placed, the computer will automatically:
 - 1) Reduce the customer's bank account by the amount of the purchase. The machine will not allow the customer to overdraw his account.
 - 2) Increase the merchant's bank account by the amount of the purchase.
 - 3) Should the purchase reduce the merchant's inventory below the reorder point on any particular item the computer will simulate an automatic reorder of the item by:
 - a) Increasing the inventory by the amount of the order
 - b) Reducing the merchant's bank account by the whole-sale price of the order
 - c) Placing a message indicating the order in the merchant's message file
 - 4) Increase the customer's and merchant's cumulative purchase file by the amount of the order.

- b. Examine his own cumulative purchase file with a particular merchant. The householder has the choice of examining either his purchases with a firm for a particular month or for the year to date.
- c. Examine his own bank account or any other account to which he has legal access. The computer will print out the running record of the bank account to date.
- d. Examine his credit rating with the bank and borrow or pay back funds. The credit rating scheme incorporated in this system is based on a scale from 0 to 3 with the debt ceiling for immediate bank credit being respectively:

0: Customer is unable to receive immediate cash credit from the bank at this time

1: Customer can receive immediate cash credit up to a ceiling of \$300

2: Customer can receive immediate cash credit up to a ceiling of \$1000

3: Customer can receive immediate cash credit up to a ceiling of \$5000

The customer's current debt balance to the bank is maintained within this part of the utility system. The system also allows the customer either to borrow up to his ceiling limit or to pay back the principal on his debt.

- e. Write a message. The user can send a message to the message file of any other user in the system.
 - f. Examine his own message file or the file of any other utility number to which he has access. The messages will be printed out by date of entry after any desired date that the user enters.
2. If the user has entered the number of a retail business he can:
- a. Examine and/or revise the inventory account of the firm. If the user wishes to examine the inventory the computer will print out for each item:

- 1) The item name
- 2) The unit of measure
- 3) Retail cost per unit
- 4) Number of units in stock
- 5) Reorder point
- 6) Amount of reorder
- 7) Wholesale cost per unit

The user is also able to add to the inventory list or to change any of the information in the list.

- b. Examine the customer cumulative purchase file. In this routine the user has the option to:
 - 1) Examine a particular customer's purchase file for a given month or for the entire year to date.
 - 2) Examine the purchase file of all customers for a given month or for the entire year to date.
 - c. Examine his bank account. This routine is identical to the one described above for householders.
 - d. Examine the bank credit rating, and borrow or pay back funds. This routine is identical to the one described above for householders.
 - e. Write a message. This routine is identical to the one described above for householders.
 - f. Examine the messages in his file. This routine is identical to the one described above for householders.
3. If the user has entered the number of a banker he can:
- a. Examine and/or alter a customer's credit rating. The credit system was described earlier. The banker has access to the credit information on all of his clients and can alter the credit positions of his clients.
 - b. Examine a client's bank account. The banker has access to the account data for all of his clients.
 - c. Write a message. This routine is identical to the one described above for households.
 - d. Examine the messages in his file. This routine is identical to the one described above for households.

While the program described here is rather complex, it has been designed to be self-explanatory to the person using the program. For additional information with respect to the use of the program and directions for altering the data refer to "Instructions for Use of the UTIL Program."

USING UTIL WITH STUDENTS

As a teacher or administrator, you should interact with this application as if you were a student.

Study the objectives, prerequisites and learning activities, and after running the program (or studying the demonstration run) use the suggested post-test for self-evaluation.

Instructional Objectives

Having completed this lesson and used the UTIL program, the student will:

1. Express in some appropriate form to others (e.g., an essay, a poem, a painting, a lecture) his feelings about facing a society in which the computer will have increasingly more influence.
2. Write a critical report about the UTIL computer program discussing his opinions about:
 - a. The kinds of jobs that probably would be eliminated if such a utility system were put into general use
 - b. The kinds of jobs that would be created if the utility were put into use
 - c. How he, as a student, can go about best preparing himself for a world in which the computer will play an important role and jobs will continually change because of it
3. Think of several ideas for each of the following categories:
 - a. The advantages of having a computer utility such as the one in the UTIL program
 - b. The disadvantages of having such a utility
 - c. Other tasks that a computer might be able to do to help a householder, a merchant, or a banker

- d. Ways that someone who wanted to sabotage the computer system might be able to do it
 - e. Ethical questions which this program suggests that society must face in the near future
 - f. The ways in which the manner that the student will spend and save money is likely to be different from those of his parents or his grandparents because of the computer
4. Argue and defend a point of view on common assertions about the computer and society.

Prerequisites

The student should know the meaning of the following terms used in the computer program, UTIL:

- 1. Inventory
- 2. Retail price
- 3. Wholesale price
- 4. Credit rating
- 5. Reorder point

Learning Activities

- 1. Review the procedures for using the stored computer program.
- 2. Discuss the program with the students and begin to discuss some of the ways in which the computer will affect their lives in the future.
- 3. Have the students run the program either individually or in small groups. Once they have become familiar with what the program does have them discuss such questions as the following as they continue to use the program:
 - a. If a computer utility like this one actually were in use, in what ways would spending money be different than it is now? Than it was when your parents were your age?
 - b. Do you think that cash and checks will ever be eliminated by the computer?
 - c. Do you like the way that the bank's credit rating system allows you to borrow money immediately?

- 1) What are some of the possible dangers of doing it this way?
 - 2) Who else should be able to find out your credit rating?
 - 3) What information should a banker have before he determines what your credit rating is?
- d. What if the computer would suddenly declare your utility number invalid and therefore you cannot prove that you even have a bank account?
- 1) Who do you think would win the argument in court, you or the computer?
 - 2) How might such a loss of identity be avoided?
 - 3) Because it is conceivable that such a disaster could happen, is it still worth having a utility system such as this?
- e. What jobs that you know of would be eliminated or drastically changed if such a computer utility were in use? What new jobs would be created by such a utility?
- f. Suppose you wanted to sabotage the system and get some information you were not entitled to have access to. How might you try and do it? What ways can you think of to improve the security of the system?
- g. If you were the decision maker for society and had to decide whether a utility system such as this one were to be implemented:
- 1) Would you permit it to be implemented?
 - 2) What questions about the system would you ask the designer?
 - 3) What pressures against deciding to use the system would you expect to receive and from whom?
 - 4) What pressures for using the system would you expect to receive and from whom?

- 5) What sorts of protections and guarantees would you want for the people most affected by the system such as those likely to lose their jobs?
 - 6) How would you try to educate people to use the system most wisely?
- h. What additional capabilities would you like to see added to the computer utility to help the householder? What additional capabilities would you not like to see added?
4. Have the students read from several social commentaries concerning the impact of the computer on society. (See the Selected Bibliography of readings.)
 5. Take a field trip to a large computer installation or review a film about the computer in society. (See Selected Bibliography for a list of films.)
 6. Discuss with the students their own feelings about the social impact of the computer; their fears and their hopes for the future.

Suggested Posttest

1. Communicate in some form of your choice (e.g., an essay, a poem, a painting, a movie, a lecture) your feelings about facing a society in which the computer will have increasingly greater influence.
2. Write a one to two page paper about the UTIL program you have been using, in which you discuss:
 - a. The kinds of jobs that probably would be eliminated if such a utility system were put into general use
 - b. The kinds of new jobs that likely would be created
 - c. The ways in which you could go about best preparing yourself for a world in which the computer will play an important role and jobs will continually change because of it

3. Give five ideas for each of the following:
 - a. The advantages to society that probably would result from having a computer utility such as the one you have been working with
 - b. The disadvantages to society that would probably result
 - c. Other things you would suggest be included in a computer utility to help a householder
4. Give three ideas for each of the following:
 - a. Ways that someone who wanted could obtain information that he was not entitled to from the utility system, UTIL
 - b. Ways that the security of the system could be improved
 - c. Serious ethical and social questions society must face concerning the use of the computer
 - d. The ways the computer will allow your generation to handle its money differently from the ways your grandparents' generation saved and spent its money
5. Write a one to two page essay taking a position and defending it, on one of the following assertions:
 - a. Since only engineers and computer programmers really understand what computers are all about, they should be the ones to make the big decisions about how the computer will be used in society.
 - b. Technology is running wild in society. The atomic bomb, industrial pollution, germ warfare, and so forth all demonstrate quite clearly that if man continues to increase his technology at the rate he is going, he will surely destroy himself. We should stop the computer's advance into the fabric of society before it is too late.

INSTRUCTIONS FOR USE OF THE UTIL PROGRAM

Responses to Questions

In order for the program to run successfully, the response to a question presented by the computer must be in the correct form; incorrect spelling may result in an incorrect response by the computer. There are many instances where an answer of YES or NO is required. In all but a very few cases, any response except a NO will be interpreted as a YES response.

When asked for the number of an option, the entry of any number except one of those in the choices will result in an error message from the computer. At the end of a completed routine, often the following message will appear:

"Do you wish to make further use of the system at this time?"

If the user types NO, then the program will terminate.

If the user types CHANGE, he will be allowed to enter a new utility identification number. This allows the user to make changes while playing one role and then change to another role without first terminating the program and eliminating those changes.

For example, the user could initially enter a home utility number and place a purchase order with a business which would cause an item in the business inventory to be reordered. Then the user could type "CHANGE" and enter the business utility number of the business from which he ordered as a householder. He could check the inventory and his bank account to see how the purchase has affected his various account.

Any other answer to the previously stated question besides NO or CHANGE will be interpreted as a YES command, giving the user the choice of selecting a bank, business or home utility option, depending upon what type of utility number he previously entered. These options are only printed once when the user enters his desired utility identification number. After the first time, the program merely asks for his choice of an option. However, if the user desires to see the options again he may type a 0 (zero) and obtain a new listing of the options.

It is very important that the user be able to distinguish between the use of the numerical 0 and the alphabetical O. These two characters are NOT interchangeable when working with the program. The user must remember to use the character which is correct, whether it be numerical or alphabetical.

Cautions

There are several other cautions to be heeded when entering answers during the operation of the program. Usually the computer will not yield the correct results when a negative amount of money is entered. The user must also avoid the impulse to try to pay back an amount which is greater than his initial debt.

In the program there is another very important fact which must be considered: answers involving only numbers are totally separate from answers involving words and combinations of letters and numbers. In an answer involving only numbers, spaces do not make any difference, and the user should not be alarmed if he accidentally puts a space where he did not intend to have one. However, answers involving combinations of letters and numbers tend to be temperamental and frequently cause problems. If the answer begins with a number, the whole answer must be enclosed in quotation marks. As long as the answer does not begin with a number, quotation marks are not necessary. When dealing with combinations of letters and numbers, spaces imbedded within the answer become part of the answer as it is stored in the computer. Those spaces on the outside of the answer are ignored unless they are enclosed in quotation marks along with the rest of the answer.

If the user wishes to terminate the program while printing is taking place, he merely has to hit the BREAK key.

Description of Utility Numbers and Accessibility

Names and associated utility numbers are:

Bank #1 - 101
Bank #2 - 102
Grocery - 201
Hardware - 202
John Smith - 301
Vikki Cohen - 302
Steve Jones - 303

Bank #1 has access to the accounts and credit ratings of:

1. Hardware
2. John Smith
3. Vikki Cohen

Bank #2 has access to the accounts and credit ratings of:

1. Grocery
2. Vikki Cohen
3. Steve Jones

The grocery has access to:

1. His account at bank #2
2. His credit rating at bank #2
3. His own inventory and price list
4. The purchase files of:
 - a. John Smith
 - b. Vikki Cohen
 - c. Steve Jones

The hardware has access to:

1. His account at bank #1
2. His credit rating at bank #1
3. His own inventory and price list
4. The purchase files of:
 - a. John Smith
 - b. Steve Jones

John Smith has access to:

1. His account at bank #1
2. His credit rating at bank #1
3. His own purchase files at the grocery and the hardware
4. The ordering routines for the grocery and the hardware

Vikki Cohen has access to:

1. Her accounts at bank #1 and bank #2
2. Her credit ratings at bank #1 and bank #2
3. Her own purchase file at the grocery
4. The ordering routine for the grocery

Steve Jones has access to:

1. His account at bank #2
2. His credit rating at bank #2
3. His own purchase files at the grocery and the hardware
4. The ordering routines for the grocery and the hardware

Each utility has access to the message files of each utility. He is able to write a message to any file, but he is only able to examine the messages to his own file.

UTIL-DEMONSTRATION RUN

THIS IS A DEMONSTRATION RUN OF THE "UTIL" PROGRAM. IT SHOWS MANY OF THE POSSIBILITIES AVAILABLE TO THE USER. IT ALSO SHOWS SOME OF THE TECHNIQUES NECESSARY FOR THE SUCCESSFUL OPERATION OF THE PROGRAM.

RUN

UTIL 22:51

WHEN ANSWERING QUESTIONS WHICH DO NOT ASK FOR AN OPTION, TYPE YES OR NO AND PRESS THE RETURN BUTTON. ANY OTHER ANSWER WILL BE INTERPRETED AS A YES COMMAND. WHEN CHOOSING AN OPTION, PICK THE NUMBER OF THE OPTION AND PRESS THE RETURN BUTTON.
PRINT THE PRESENT DATE IN THE FORM 00-00-00 USING QUOTATION MARKS.
WHAT IS THE DATE ?"12-02-69"

DO YOU WISH TO SEE AN INTRODUCTORY DESCRIPTION OF THE
UTILITY PROGRAM ?YES

THIS PROGRAM IS AN ELEMENTARY MODEL OF A COMPUTER BASED UTILITY SYSTEM. IT HAS BEEN DESIGNED TO DEMONSTRATE SOME OF THE WAYS IN WHICH A COMPUTER SYSTEM OF THE NOT TOO DISTANT FUTURE MIGHT BE ABLE TO HELP MAN FACILITATE MANY OF THE ACTIVITIES WHICH INVOLVE CLOSE COORDINATION AMONG VARIOUS MEMBERS OF SOCIETY. THIS PARTICULAR PROGRAM DEMONSTRATES SUCH A USE OF THE COMPUTER WITH RESPECT TO SOME OF THE COMMON FINANCIAL ACTIVITIES WHICH TRANSPIRE AMONG HOUSEHOLDS, BUSINESSES, AND BANKS. HOPEFULLY BY USING THIS PROGRAM YOU WILL COME TO THINK MORE SERIOUSLY AND KNOWLEDGEABLY ABOUT SOME OF THE TREMENDOUS POSSIBILITIES OF USING THE COMPUTER AS THE BASIS OF SOCIAL UTILITY SYSTEMS. ALSO, HOPEFULLY, YOU WILL BEGIN TO THINK MORE SERIOUSLY ABOUT SOME OF THE SOCIAL IMPLICATIONS, FOR EXAMPLE THE IMPLICATIONS ON WORK, OF SUCH COMPUTER BASED SYSTEMS.

WHAT IS YOUR UTILITY IDENTIFICATION NUMBER ?302

THE FOLLOWING ARE THE HOME OPTIONS AVAILABLE TO YOU:

- 1.PLACE A PURCHASE ORDER
- 2.EXAMINE A CUMULATIVE PURCHASE FILE
- 3.EXAMINE YOUR BANK ACCOUNT
- 4.EXAMINE BANK CREDIT RATING: BORROW OR PAY BACK FUNDS
- 5.WRITE A MESSAGE
- 6.EXAMINE THE MESSAGES TO YOUR FILE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?1

UTIL-DEMONSTRATION RUN CONTINUED

DO YOU WISH TO EXECUTE THE ORDER ?YES

WHAT IS THE NUMBER OF THE PRESENT MONTH ?12

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE HOME OPTION WHICH YOU CHOOSE ?2

WHAT IS THE UTILITY NUMBER OF THE FIRM ?201

THE FOLLOWING ARE THE OPTIONS OPEN TO YOU:

1.EXAMINE YOUR PURCHASE TOTAL BY MONTH

2.EXAMINE YOUR YEARLY PURCHASE TOTAL TO DATE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?1

WHAT IS THE ITEM NUMBER YOU WISH TO CHECK ?2

WHAT IS THE NUMBER OF THE MONTH YOU ARE INTERESTED IN ?12

BUSINESS: GROCERY

NAME: VIKKI COHEN

ITEM: MILK

UNIT: QUART

MONTH NUMBER: 12

NUMBER OF PURCHASES: 5

DO YOU WISH TO CHECK ANY OTHER MONTHS FOR THIS ITEM ?YES

WHAT IS THE NUMBER OF THE MONTH YOU ARE INTERESTED IN ?6

BUSINESS: GROCERY

NAME: VIKKI COHEN

ITEM: MILK

UNIT: QUART

MONTH NUMBER: 6

NUMBER OF PURCHASES: 0

DO YOU WISH TO CHECK ANY OTHER MONTHS FOR THIS ITEM ?NO

DO YOU WISH TO CHECK ANY OTHER ITEMS FOR THIS FILE ?YES

WHAT IS THE ITEM NUMBER YOU WISH TO CHECK ?7

WHAT IS THE NUMBER OF THE MONTH YOU ARE INTERESTED IN ?12

UTIL-DEMONSTRATION RUN CONTINUED

WHAT IS THE UTILITY NUMBER OF THE FIRM WHERE YOU WISH TO
PLACE AN ORDER ?201

DO YOU WISH TO SEE THE CURRENT INVENTORY AND PRICE LIST
OF THE FIRM ?YES

BUSINESS: GROCERY

ITEM#	ITEM NAME	UNIT	RETAIL COST/UNIT
1	BREAD	LOAF	\$0.33
2	MILK	QUART	\$0.27
3	CHEESE	POUND	\$1.65
4	GND BEEF	POUND	\$0.69
5	CEREAL	BOX	\$0.47
6	SUGAR	10 LB	\$0.89
7	BUTTER	POUND	\$0.39

HOW MANY DISTINCT ITEMS DO YOU WISH TO ORDER ?7

WHAT IS THE UTILITY NUMBER OF THE BANK WITH
WHICH YOU WISH TO COMPLETE THE TRANSACTION ?102

WHAT IS THE 1 ST ITEM NUMBER ?2
WHAT QUANTITY DO YOU WISH TO ORDER ?3

WHAT IS THE 2 ND ITEM NUMBER ?3
WHAT QUANTITY DO YOU WISH TO ORDER ?1

WHAT IS THE 3 RD ITEM NUMBER ?1
WHAT QUANTITY DO YOU WISH TO ORDER ?2

WHAT IS THE 4 TH ITEM NUMBER ?5
WHAT QUANTITY DO YOU WISH TO ORDER ?1

WHAT IS THE 5 TH ITEM NUMBER ?7
WHAT QUANTITY DO YOU WISH TO ORDER ?4

WHAT IS THE 6 TH ITEM NUMBER ?6
WHAT QUANTITY DO YOU WISH TO ORDER ?1

WHAT IS THE 7 TH ITEM NUMBER ?4
WHAT QUANTITY DO YOU WISH TO ORDER ?2

YOUR TOTAL BILL FOR THIS ORDER IS \$7.42
YOUR NEW BALANCE WILL BE \$268.02

UTIL-DEMONSTRATION RUN CONTINUED

DO YOU WISH TO CHECK ANY OTHER ITEMS ?YES

WHAT IS THE ITEM NUMBER YOU WISH TO CHECK ?3
WHAT IS THE NUMBER OF THE PRESENT MONTH ?12

BUSINESS: GROCERY

NAME: VIKKI COHEN
ITEM: CHEESE
UNIT: POUND

MONTH NUMBER NUMBER OF PURCHASES

1	1
2	2
3	3
4	1
5	2
6	3
7	2
8	3
9	3
10	2
11	1
12	3

TOTAL YEARLY PURCHASES: 26

DO YOU WISH TO CHECK ANY OTHER ITEMS ?NO

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE HOME OPTION WHICH YOU CHOOSE ?3

WHAT IS THE UTILITY NUMBER OF THE BANK WHERE
YOU WISH TO SEE YOUR BANK ACCOUNT ?102

BANK #2

DATE	DEBIT	CREDIT	BALANCE
06-21-69	\$0.00	\$49.83	\$201.12
06-28-69	\$17.14	\$0.00	\$183.98
07-13-69	\$29.78	\$0.00	\$154.20
08-11-69	\$0.00	\$25.83	\$180.03
09-12-69	\$0.00	\$95.41	\$275.44
12-02-69	\$7.42	\$0.00	\$268.02

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

90

UTIL-DEMONSTRATION RUN CONTINUED

BUSINESS: GROCERY

NAME: VIKKI COHEN

ITEM: BUTTER

UNIT: POUND

MONTH NUMBER: 12

NUMBER OF PURCHASES: 6

DO YOU WISH TO CHECK ANY OTHER MONTHS FOR THIS ITEM ?YES

WHAT IS THE NUMBER OF THE MONTH YOU ARE INTERESTED IN ?4

BUSINESS: GROCERY

NAME: VIKKI COHEN

ITEM: BUTTER

UNIT: POUND

MONTH NUMBER: 4

NUMBER OF PURCHASES: 1

DO YOU WISH TO CHECK ANY OTHER MONTHS FOR THIS ITEM ?NO

DO YOU WISH TO CHECK ANY OTHER ITEMS FOR THIS FILE ?NO

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE HOME OPTION WHICH YOU CHOOSE ?2

WHAT IS THE UTILITY NUMBER OF THE FIRM ?201

THE FOLLOWING ARE THE OPTIONS OPEN TO YOU:

1.EXAMINE YOUR PURCHASE TOTAL BY MONTH

2.EXAMINE YOUR YEARLY PURCHASE TOTAL TO DATE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?2

WHAT IS THE ITEM NUMBER YOU WISH TO CHECK ?5

WHAT IS THE NUMBER OF THE PRESENT MONTH ?12

BUSINESS: GROCERY

NAME: VIKKI COHEN

ITEM: CEREAL

UNIT: BOX

MONTH NUMBER NUMBER OF PURCHASES

1	1
4	1
9	1
10	1
11	2
12	2

TOTAL YEARLY PURCHASES: 8

81

UTIL-DEMONSTRATION RUN CONTINUED

WHAT IS THE NUMBER OF THE HOME OPTION WHICH YOU CHOOSE ?0

THE FOLLOWING ARE THE HOME OPTIONS AVAILABLE TO YOU:

- 1.PLACE A PURCHASE ORDER
- 2.EXAMINE A CUMULATIVE PURCHASE FILE
- 3.EXAMINE YOUR BANK ACCOUNT
- 4.EXAMINE BANK CREDIT RATING: BORROW OR PAY BACK FUNDS
- 5.WRITE A MESSAGE
- 6.EXAMINE THE MESSAGES TO YOUR FILE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?4

DO YOU WISH TO SEE AN EXPLANATION OF THE CREDIT RATING SYSTEM ?YES

THE CREDIT RATING ASPECT OF THIS UTILITY ALLOWS THE BANKER AND THE INDIVIDUAL BANK CUSTOMER TO REMAIN IN CLOSE AND CONTINUOUS COMMUNICATION CONCERNING THE INDIVIDUAL'S CREDIT POSITION WITH THE BANK. THE CREDIT RATING SCHEME IS BASED ON AN INTEGER SCALE FROM 0 TO 3 WITH THE DEBT CEILING FOR IMMEDIATE CREDIT BEING RESPECTIVELY:

- 0: CUSTOMER IS UNABLE TO RECEIVE IMMEDIATE CREDIT FROM THE BANK AT THIS TIME.
- 1: CUSTOMER CAN RECEIVE IMMEDIATE CASH CREDIT UP TO A CEILING OF \$300.
- 2: CUSTOMER CAN RECEIVE IMMEDIATE CASH CREDIT UP TO A CEILING OF \$1000.
- 3: CUSTOMER CAN RECEIVE IMMEDIATE CASH CREDIT UP TO A CEILING OF \$5000.

THE CUSTOMER'S CURRENT DEBT BALANCE TO THE BANK IS MAINTAINED WITHIN THIS PART OF THE UTILITY SYSTEM AND THE SYSTEM ALSO ALLOWS THE CUSTOMER EITHER TO BORROW UP TO HIS CEILING LIMIT OR PAY BACK PRINCIPLE ON HIS DEET.

WHAT IS THE UTILITY NUMBER OF THE BANK WHERE YOU WISH TO CHECK YOUR CREDIT ?102

YOUR CREDIT RATING AT BANK #2 IS 3
THERE IS A CURRENT DEBT OF \$3503.00

THE FOLLOWING OPTIONS ARE AVAILABLE TO YOU:

- 1.LEAVE THIS PART OF THE PROGRAM
- 2.BORROW ADDITIONAL FUNDS
- 3.REPAY PART OR ALL OF THE DEBT PRINCIPLE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?2

UTIL-DEMONSTRATION RUN CONTINUED

HOW MUCH DO YOU WISH TO BORROW? \$ 250.00

THE TRANSACTION HAS BEEN COMPLETED.

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE HOME OPTION WHICH YOU CHOOSE ?4

DO YOU WISH TO SEE AN EXPLANATION OF THE CREDIT RATING SYSTEM ?NO

WHAT IS THE UTILITY NUMBER OF THE BANK WHERE
YOU WISH TO CHECK YOUR CREDIT ?102

YOUR CREDIT RATING AT BANK #2 IS 3
THERE IS A CURRENT DEBT OF \$3753.00

THE FOLLOWING OPTIONS ARE AVAILABLE TO YOU:

- 1.LEAVE THIS PART OF THE PROGRAM
- 2.BORROW ADDITIONAL FUNDS
- 3.REPAY PART OR ALL OF THE DEBT PRINCIPLE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?3

HOW MUCH DO YOU WISH TO PAY BACK? \$ 83.50

THE TRANSACTION HAS BEEN COMPLETED.

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE HOME OPTION WHICH YOU CHOOSE ?3

WHAT IS THE UTILITY NUMBER OF THE BANK WHERE
YOU WISH TO SEE YOUR BANK ACCOUNT ?102

BANK #2

DATE	DEBIT	CREDIT	BALANCE
06-21-69	\$0.00	\$49.83	\$201.12
06-28-69	\$17.14	\$0.00	\$183.98
07-13-69	\$22.78	\$0.00	\$154.20
08-11-69	\$0.00	\$25.83	\$180.03
09-12-69	\$0.00	\$25.41	\$205.44
12-02-69	\$7.42	\$0.00	\$198.02
12-02-69	\$0.00	\$250.00	\$448.02
12-02-69	\$83.50	\$0.00	\$364.52

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE HOME OPTION WHICH YOU CHOOSE ?5

UTIL-DEMONSTRATION RUN CONTINUED

WHAT IS THE UTILITY NUMBER OF THE FILE TO WHICH YOU WISH
TO WRITE A MESSAGE ?102

TYPE THE MESSAGE WITHIN THE QUOTATION MARKS WHICH WILL FOLLOW.
WHAT IS THE MESSAGE? "SEND BANK STATEMENT "

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE HOME OPTION WHICH YOU CHOOSE ?6

THIS ROUTINE WILL PRINT OUT ALL MESSAGES AFTER A GIVEN DATE.
ENTER THE REFERENCE DATE IN THE FORM 00-00-00 USING QUOTATION MARKS.
WHAT IS THE DATE DESIRED ?"06-23-69"

DATE	MESSAGE	SOURCE OF MESSAGE
11-03-69	ACCOUNT OVERDRAWN	BANK #2
11-15-69	31 NOT AVAILABLE	GROCERY

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?CHANGE

NOTE: THE USER IS NOW ABLE TO CHANGE HIS UTILITY IDENTIFICATION
NUMBER. THE NEXT PAGE IS THE BEGINNING OF AN ILLUSTRATION
OF THE OPTIONS AVAILABLE TO A BUSINESS.

UTIL-DEMONSTRATION P'N CONTINUED

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?3

WHAT IS THE ITEM NUMBER OF THE FILE YOU WISH TO REVISE ?6
WHAT IS THE CATEGORY NUMBER OF THE CELL YOU WISH TO REVISE ?3
WHAT IS THE CELL VALUE? \$.99

DO YOU WISH TO REVISE ANY MORE OF THE CELLS UNDER THIS
SAME ITEM ?NO

DO YOU WISH TO MAKE ANY MORE REVISIONS IN THE
INVENTORY ACCOUNT ?NO

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BUSINESS OPTION WHICH YOU CHOOSE ?2

THE FOLLOWING OPTIONS ARE OPEN TO YOU:

- 1.EXAMINE A CUSTOMER'S CUMULATIVE PURCHASES BY MONTH
- 2.EXAMINE THE TOTAL PURCHASES OF A CUSTOMER
- 3.EXAMINE MONTHLY PURCHASES ACROSS CUSTOMERS
- 4.EXAMINE YEARLY PURCHASES ACROSS CUSTOMERS

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?1

WHAT IS THE UTILITY NUMBER OF THE ACCOUNT YOU WISH TO
EXAMINE ?301

WHAT IS THE ITEM NUMBER YOU WISH TO CHECK ?4
WHAT IS THE NUMBER OF THE MONTH YOU ARE INTERESTED IN ?7

BUSINESS: GROCERY

NAME: JOHN SMITH
ITEM: GND BEEF
UNIT: POUND
MONTH NUMBER: 7
NUMBER OF PURCHASES: 3

DO YOU WISH TO CHECK ANY OTHER MONTHS FOR THIS ITEM ?NO
DO YOU WISH TO CHECK ANY OTHER ITEMS FOR THIS FILE ?NO
DO YOU WISH TO EXAMINE ANY OTHER CUSTOMER'S ACCOUNTS ?NO

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BUSINESS OPTION WHICH YOU CHOOSE ?2

THE FOLLOWING OPTIONS ARE OPEN TO YOU:

- 1.EXAMINE A CUSTOMER'S CUMULATIVE PURCHASES BY MONTH
- 2.EXAMINE THE TOTAL PURCHASES OF A CUSTOMER
- 3.EXAMINE MONTHLY PURCHASES ACROSS CUSTOMERS
- 4.EXAMINE YEARLY PURCHASES ACROSS CUSTOMERS

UTIL-DEMONSTRATION RUN CONTINUED

WHAT IS YOUR UTILITY IDENTIFICATION NUMBER ?201

THE FOLLOWING ARE THE BUSINESS OPTIONS AVAILABLE TO YOU:

- 1.EXAMINE AND/OR REVISE THE INVENTORY ACCOUNT
- 2.EXAMINE THE CUSTOMER'S CUMULATIVE PURCHASE FILE
- 3.EXAMINE YOUR BANK ACCOUNT
- 4.WRITE A MESSAGE
- 5.EXAMINE THE MESSAGES TO YOUR FILE
- 6.EXAMINE BANK CREDIT RATING: BORROW OR PAY BACK FUNDS

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?1

DO YOU WISH TO EXAMINE THE INVENTORY ACCOUNT ?YES

GROCERY

ITEM#	ITEM NAME	UNIT	RETAIL COST/UNIT	# OF UNITS IN STOCK	REORDER POINT	AMOUNT OF REORDER	WHOLESALE COST/UNIT
1	BREAD	LOAF	\$0.33	13	10	12	\$0.20
2	MILK	QUART	\$0.27	21	15	10	\$0.15
3	CHEESE	POUND	\$1.65	20	12	10	\$1.02
4	GND BEEF	POUND	\$0.69	23	15	20	\$0.42
5	CEREAL	BOX	\$0.47	41	20	30	\$0.23
6	SUGAR	10 LB	\$0.89	16	12	10	\$0.58
7	BUTTER	POUND	\$0.39	29	20	20	\$0.18

THE FOLLOWING OPTIONS ARE OPEN TO YOU:

- 1.LEAVE THIS PART OF THE PROGRAM
- 2.CREATE A NEW INVENTORY FILE
- 3.REVISE AN OLD INVENTORY FILE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?2

WHAT IS THE NAME OF THE ITEM ?JAM

WHAT IS THE UNIT WHICH THE ITEM COMES IN ?JAR

WHAT IS THE RETAIL COST PER UNIT ?\$. 59

HOW MANY UNITS ARE IN STOCK ?34

WHAT IS THE REORDER POINT ?16

WHAT IS THE AMOUNT OF REORDER ?30

WHAT IS THE WHOLESALE COST PER UNIT? \$.28

DO YOU WISH TO WORK ANY FURTHER WITH THE INVENTORY FILE ?YES

THE FOLLOWING OPTIONS ARE OPEN TO YOU:

- 1.LEAVE THIS PART OF THE PROGRAM
- 2.CREATE A NEW INVENTORY FILE
- 3.REVISE AN OLD INVENTORY FILE

UTIL-DEMONSTRATION RUN CONTINUED

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?2

WHAT IS THE UTILITY NUMBER OF THE ACCOUNT YOU WISH TO EXAMINE ?303

WHAT IS THE ITEM NUMBER YOU WISH TO CHECK ?2

WHAT IS THE NUMBER OF THE PRESENT MONTH ?12

BUSINESS: GROCERY

NAME: STEVE JONES

ITEM: MILK

UNIT: QUART

MONTH NUMBER	NUMBER OF PURCHASES
--------------	---------------------

1	1
3	3
4	2
5	1
6	3
8	1
9	1
11	1
12	1

TOTAL YEARLY PURCHASES: 14

DO YOU WISH TO CHECK ANY OTHER ITEMS ?NO

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BUSINESS OPTION WHICH YOU CHOOSE ?2

THE FOLLOWING OPTIONS ARE OPEN TO YOU:

- 1.EXAMINE A CUSTOMER'S CUMULATIVE PURCHASES BY MONTH
- 2.EXAMINE THE TOTAL PURCHASES OF A CUSTOMER
- 3.EXAMINE MONTHLY PURCHASES ACROSS CUSTOMERS
- 4.EXAMINE YEARLY PURCHASES ACROSS CUSTOMERS

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?3

WHAT IS THE ITEM NUMBER YOU WISH TO CHECK ?6

WHAT IS THE NUMBER OF THE MONTH YOU ARE INTERESTED IN ?10

UTIL-DEMONSTRATION RUN CONTINUED

BUSINESS: GROCERY

NAME: JOHN SMITH
ITEM: SUGAR
UNIT: 10 LB
MONTH NUMBER: 10
NUMBER OF PURCHASES: 0

NAME: VIKKI COHEN
ITEM: SUGAR
UNIT: 10 LB
MONTH NUMBER: 10
NUMBER OF PURCHASES: 1

NAME: STEVE JONES
ITEM: SUGAR
UNIT: 10 LB
MONTH NUMBER: 10
NUMBER OF PURCHASES: 1

DO YOU WISH TO CHECK ANY OTHER MONTHS FOR THIS ITEM ?NO
DO YOU WISH TO CHECK ANY OTHER ITEMS ?NO

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BUSINESS OPTION WHICH YOU CHOOSE ?2

THE FOLLOWING OPTIONS ARE OPEN TO YOU:
1.EXAMINE A CUSTOMER'S CUMULATIVE PURCHASES BY MONTH
2.EXAMINE THE TOTAL PURCHASES OF A CUSTOMER
3.EXAMINE MONTHLY PURCHASES ACROSS CUSTOMERS
4.EXAMINE YEARLY PURCHASES ACROSS CUSTOMERS

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?4

WHAT IS THE ITEM NUMBER YOU WISH TO CHECK ?5
WHAT IS THE NUMBER OF THE PRESENT MONTH ?12

BUSINESS: GROCERY

NAME: JOHN SMITH
ITEM: CEREAL
UNIT: BOX

MONTH NUMBER NUMBER OF PURCHASES

2	1
3	2
5	2
6	1
7	4
10	2
11	1
12	2

UTIL-DEMONSTRATION RUN CONTINUED

TOTAL YEARLY PURCHASES: 15

NAME: VIKKI COHEN
ITEM: CEREAL
UNIT: BOX

MONTH NUMBER	NUMBER OF PURCHASES
1	1
4	1
9	1
10	1
11	2
12	2

TOTAL YEARLY PURCHASES: 8

NAME: STEVE JONES
ITEM: CEREAL
UNIT: BOX

MONTH NUMBER	NUMBER OF PURCHASES
1	1
4	1
5	1
7	1
8	1
9	1
11	2
12	1

TOTAL YEARLY PURCHASES: 9

DO YOU WISH TO CHECK ANY OTHER ITEMS ?NO

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BUSINESS OPTION WHICH YOU CHOOSE ?6

DO YOU WISH TO SEE AN EXPLANATION OF THE CREDIT RATING SYSTEM ?NO

WHAT IS THE UTILITY NUMBER OF THE BANK WHERE
YOU WISH TO CHECK YOUR CREDIT ?102

UTIL-DEMONSTRATION RUN CONTINUED

YOUR CREDIT RATING AT BANK #2 IS 2
THERE IS A CUPRENT DEET OF \$800.00

THE FOLLOWING OPTIONS ARE AVAILABLE TO YOU:
1.LEAVE THIS PART OF THE PROGRAM
2.BORROW ADDITIONAL FUNDS
3.REPAY PART OR ALL OF THE DEBT PRINCIPLE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHCOSE ?3

HOW MUCH DO YOU WISH TO PAY BACK? \$ 132.50

THE TRANSACTION HAS BEEN COMPLETED.

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BUSINESS OPTION WHICH YOU CHOOSE ?3

WHAT IS THE UTILITY NUMBER OF THE BANK WHERE
YOU WISH TO SEE YOUR BANK ACCOUNT ?102

BANK #2

DATE	DEBIT	CREDIT	BALANCE
05-14-69	\$31.39	\$0.00	\$339.31
05-19-69	\$23.79	\$0.00	\$255.52
06-09-69	\$0.00	\$29.17	\$284.69
10-15-69	\$76.83	\$0.00	\$207.86
12-02-69	\$132.50	\$0.00	\$75.36

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BUSINESS OPTION WHICH YOU CHOCSE ?5

THIS ROUTINE WILL PRINT OUT ALL MESSAGES AFTER A GIVEN DATE.
ENTER THE REFERENCE DATE IN THE FORM CC-00-00 USING QUOTATION MARKS.
WHAT IS THE DATE DESIRED ?"04-20-69"

DATE	MESSAGE	SOURCE OF MESSAGE
05-14-69	REQUEST BALANCE STATEMENT	VIKKI COHEN
05-25-69	ORDER BRAND 3 BREAL	JOHN SMITH
06-03-69	MAKE LOAN PAYMENT	BANK #2

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?CHANGE

NOTE: THE NEXT PAGE IS THE BEGINNING OF AN ILLUSTRATION OF THE
OPTIONS AVAILABLE TO A BANK.

UTIL-DEMONSTRATION RUN CONTINUED

WHAT IS YOUR UTILITY IDENTIFICATION NUMBER ?102

THE FOLLOWING ARE THE BANK OPTIONS AVAILABLE TO YOU:

- 1.EXAMINE AND/OR ALTER A CUSTOMER'S CREDIT RATING
- 2.EXAMINE CUSTOMER'S BANK ACCOUNT
- 3.WRITE A MESSAGE
- 4.EXAMINE THE MESSAGES TO YOUR FILE

WHAT IS THE NUMBER OF THE OPTION WHICH YOU CHOOSE ?1

DO YOU WISH TO SEE AN EXPLANATION OF THE CREDIT RATING SYSTEM ?NO

WHAT IS THE UTILITY NUMBER OF THE ACCOUNT YOU WISH TO EXAMINE ?201

THE PRESENT CREDIT RATING FOR THIS ACCOUNT IS 2
THERE IS A CURRENT DEBT OF \$667.50

DO YOU WISH TO CHANGE THE RATING ?YES
WHAT IS THE NEW RATING ?3

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BANK OPTION WHICH YOU CHOOSE ?2

WHAT IS THE UTILITY NUMBER OF THE ACCOUNT WHICH YOU WISH TO
EXAMINE ?303

STEVE JONES

DATE	DEBIT	CREDIT	BALANCE
08-11-69	\$57.26	\$0.00	\$323.58
09-27-69	\$45.44	\$0.00	\$278.14
10-08-69	\$0.00	\$30.64	\$308.78
11-21-69	\$8.85	\$0.00	\$299.93

DO YOU WISH TO EXAMINE ANY OTHER ACCOUNTS ?NO

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?YES

WHAT IS THE NUMBER OF THE BANK OPTION WHICH YOU CHOOSE ?4

THIS ROUTINE WILL PRINT OUT ALL MESSAGES AFTER A GIVEN DATE.
ENTER THE REFERENCE DATE IN THE FORM OC-00-00 USING QUOTATION MARKS.
WHAT IS THE DATE DESIRED ?"08-20-69"

UTIL-DEMONSTRATION RUN CONTINUED

DATE	MESSAGE	SOURCE OF MESSAGE
1-05-69	REQUEST ACCOUNT STATEMENT	VIKKI COHEN
11-05-69	REQUEST BALANCE STATEMENT	GROCERY
12-02-69	SEVL BANK STATEMENT	VIKKI COHEN

DO YOU WISH TO MAKE FURTHER USE OF THE SYSTEM AT THIS TIME ?NO

READY
IC

.K

CONFIRM:U

JOB 6, USER [310,310] LOGGED OFF TTY6 2331

CONNECT TIME: 40 MIN, 4.5 SEC.

SAVED ALL 7 FILES (INCLUDING UFD, 105. DISK BLOCKS)

Instructions for the Alteration of Data (For the teacher who wishes to use the program with data other than that supplied.)

Here each type of data will be considered in relation to use and alteration. In some cases, alteration of the data requires a great deal of change in the program itself, so it is not advisable. Wherever alteration is possible without a great deal of work it will be discussed, even though it may be impractical. The lines containing data are located at the end of the program and are identified in REM statements.

First Section

The first section contains the number of bank, business and home utilities, respectively. The first number in line 23400 is the number of banks. The second number is the number of businesses. The third number is the number of homes. The work required to change the number of utility numbers in any category is ridiculous when compared to the advantages obtained. The necessary alterations would require the knowledge of the programmer or someone who knew the program quite well.

Second Section

The second section contains the utility numbers of each bank, business and home. The numbers in line 23600 are the bank utility numbers. The numbers in line 23800 are the business utility numbers. The numbers in line 2400 are the home utility numbers. It is not possible to make changes in this section without first making changes in the first section, which was already discussed.

Third Section

The third section contains the number of bank, business and home utilities accessible by each utility number. Line 24200 contains the banks accessible by each utility. Line 24400 contains the number of businesses accessible by each utility. Line 24600 contains the number of homes accessible by each utility. By using the following example, the format of the third section can be discussed:

```
24100 REM NUMBER OF BANKS ACCESSIBLE BY EACH UTILITY
24200 DATA 1,1,1,1,1,2,1
```


In the example above, the first two numbers represent the number of banks accessible by bank #1 and bank #2, respectively. The third and fourth numbers represent the number of banks accessible by the grocery and the hardware respectively. The fifth, sixth and seventh numbers represent the number of banks accessible by John Smith, Vikki Cohen and Steve Jones, respectively. The same format applies to lines 24400 and 24600. In order to change the number of utilities accessible by each utility, the user must change the appropriate number in section three and also in the other sections which apply.

Fourth Section

The fourth section contains the utility numbers accessible by each utility number. There are three sub-sections to this section. The first sub-section contains lines 24800, 25000 and 25200. These lines correspond to the first line in section three.

The next two groups of three data lines also correspond to the second and third lines of section three respectively. The following example illustrates the format of this section.

```
25100 REM NUMBERS OF BANKS ACCESSIBLE BY EACH HOME
25200 DATA 101,101,102,102
```

By looking in section three, line 24200, it is evident that the homes have access to one, two, and one bank respectively. The first number in line 25200 is the bank number accessible by John Smith. The next two numbers are the bank numbers accessible by Vikki Cohen. The last number is the bank number accessible by Steve Jones. Changes in this section only occur along with changes in section three. The proper utility number must be inserted in the proper line according to the change made in section three.

Fifth Section

The fifth section contains the credit ratings and debts of each business and home at each bank. If the business or home does not have a bank account at a bank it still gets a credit rating and debt for that bank, although they are both equal to zero. If one of the businesses or homes obtains a bank account at a bank where it did not previously have one, the user must merely insert the desired credit rating and debt in the appropriate data

line. The data lines for this section are lines 26500 through 28400. The first number in each line is the credit rating and the second number is the debt. The credit rating system is explained in the credit section of the program.

Sixth Section

The sixth section of the program contains the debt ceilings for the credit section of the program. These can easily be changed if the user desires. The first number is the debt ceiling for a credit rating of 1. The second number is the debt ceiling for a credit rating of 2. The third number is the debt ceiling for a credit rating of 3. These numbers, as all monetary amounts in this program, are expressed in cents. For example, \$3.00 is expressed as 300 throughout the program. This applies to responses made by the user as well as data which is already stored in the computer. When changing the debt ceilings it must be remembered that bank customers with credit ratings corresponding to a certain debt ceiling must not have debts which exceed the debt ceiling.

Seventh Section

The seventh section contains the number of bank transactions for each business and home. The following is the data line which is associated with this section.

28800 DATA -1,5,4,5,-1,4,-1,-1,5,4

The first five numbers correspond to bank #1 and the second five numbers correspond to bank #2. The first two numbers in each section of five correspond to the transactions for the grocery and the hardware, respectively. The last three numbers in each section correspond to the transactions for John Smith, Vikki Cohen and Steve Jones respectively. If the utility number does not have an account at the bank then a "-1" has been placed where a positive number would otherwise be if the utility number had an account at the bank. In order to change the number of transactions for an account at a certain bank the user must make sure that the business or home does actually have an account at the bank. Then additional transactions must be added to section eight. If a business or home is being given access to a new bank, then transactions must be provided for that utility number at the bank. The number of transactions must also be entered in section seven.

Eighth Section

The eighth section contains the transactions for each business and home at each bank. If the utility number does not have an account at a bank, then there is a REM statement which states this fact. It will be found in the appropriate place in the data section of the program. The lines which contain transactions are lines 28900 through 35200. The transactions are arranged according to the order in section seven. There are two basic groups corresponding to bank #1 and bank #2. Each of these sections either contains transactions for each business and home or else it contains a REM statement which states that the particular utility number does not have an account at the bank. When changes are made in this section they must be accompanied by the appropriate changes in section seven. There must be the same number of transactions as is specified in section seven. An example of the format of this section follows.

```
31000 REM TRANSACTIONS FOR VIKKI COHEN AT BANK #1
31100 DATA "08-12-69"
31200 DATA 0,1990,27074
```

The data in line 31100 is a string variable and is the same as a word. It is the date that the particular transaction has taken place. The first number in line 31200 is the debit for the transaction. The second number is the credit for the transaction. The third number is the balance after the transaction has taken place. As before, these numbers represent the number of cents. For example, the second number in line 31200 represents \$19.90. When a transaction is added to a customer's account, it must be placed so that the dates for the account are in chronological order. Ample space has been provided for additions in any part of the data section. Each new transaction must contain one line with the date in quotation marks and one line with the debit, credit and balance. As in the example, if only the credit part is present, then the debit will be zero and must be represented by a zero in the debit position.

Ninth Section

The ninth section contains the number of messages to each file. The first two numbers in line 35400 represent the number of messages to bank #1 and bank #2 respectively. The third and fourth numbers represent the number of messages to the grocery and the hardware respectively. The last three numbers represent the number of messages to John Smith, Vikki Cohen and Steve Jones, respectively. Any change in this section must also include a change in section ten.

Tenth Section

The tenth section contains the messages to each file. The messages are arranged in the same order as the numbers in section nine. The following example shows the format of the tenth section.

```
35500 REM MESSAGES TO BANK #1
35600 DATA "05-10-69"
35700 DATA "REQUEST CHECKS"
35800 DATA "JOHN SMITH"
```

When changing data in this section, one message must contain three parts. The first line of the new message must contain the date it was written. The second line must contain the message. The third line must contain the source of the message. When placing the new message in the data section, it must be in the appropriate file and it must be in a position which will place all of the messages to the file in chronological order. When a new message is added, the number of messages to the file must be increased in section nine.

Eleventh Section

The eleventh section contains the names of the utility numbers. They are arranged in the order of the utility numbers in section two. The bank and business names are in line 43200 and the home names are in line 43300. This section cannot be altered without alteration of section one, which was already discussed.

Twelfth Section

The twelfth section contains the number of items in the inventories of the grocery and the hardware. In order to alter the data in line 43500, the user must make corresponding changes in section thirteen. An addition in section twelve must be accompanied by an addition in section thirteen. The first number in line 43500 is the number of items in the grocery inventory and the second number is the number of items in the hardware inventory.

Thirteenth Section

The thirteenth section contains the items in the inventories of the grocery and the hardware. The following example will illustrate the format of this section.

```
43600 REM ITEMS IN GROCERY INVENTORY
43700 DATA "BREAD", "LOAF", 33,15,10,12,20
```

The first word in line 43700 is the name of the item. The second word is the unit which the item comes in. The first number in line 43700 is the retail cost of the item in cents. The second number is the number of units in stock. The third number is the reorder point for the item. The fourth number is the amount of reorder for the item. The fifth number is the wholesale cost of the item per unit in cents. When an item is added to the inventory of one of the businesses, the number of items in the inventory must be increased in section twelve and the data for the item must be entered under the appropriate business. It does not make any difference what order the items are in as long as they are under the proper business. The addition of an item also requires changes in section fourteen. A purchase file must be provided for each customer for each item that is added.

Fourteenth Section

The fourteenth section contains the purchase files of the customers for each business. The data lines associated with this section are lines 45100 through 52800. The following example will illustrate the format of this section.

```
45100 REM JOHN SMITH PURCHASES AT GROCERY-BREAD
45200 DATA 0,1,2,0,1,3,2,0,1,3,2,1
```

The REM statement tells the name of the customer, the name of the business and the name of the item. The data line contains the number of purchases for each month during the year. The first number in line 45200 is the number of purchases for the first month and so on. The first half of this section is the purchase files for the grocery. The second half of the section is the purchase files for the hardware. Within each of these halves, there is one third devoted to the purchases of each customer, even if he does not

have access to the business, as in the case of Vikki Cohen at the hardware. The purchases for each customer for each item at each business are arranged in the same order as the items in section thirteen. An addition in section thirteen must be accompanied by the addition of a purchase file for each customer for the item. The purchase file must be in the same position with respect to the other purchase files for the business as the item is with respect to the other items in section thirteen.

APPLICATION XII: Planning Programming Budgeting System

School Administrator Training Course.

Pursuant to
U.S.O.E. Contract #OEC-4-7-062871-3059



program REACT

August 1971

For further information, contact

Dr. Duane Richardson, Coordinator
Program REACT
Northwest Regional Educational Laboratory
710 S. W. Second
500 Lindsay Building
Portland, Oregon 97204

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INTRODUCTION

The school administrator today is confronted with the problem of providing an ever increasing range of programs and services while facing mounting concern for the level of school taxation and expenditures. In this light, it is natural that the Planning-Programming-Budgeting System, as popularized for governmental use by the Department of Defense, has exhibited some appeal for school administrators and school boards. PPBS is the acronym commonly used for Planning-Programming-Budgeting System.

There are several steps which constitute what is commonly agreed upon as PPBS. These are:

1. State measurable objectives
2. Assign priorities to stated objectives
3. Determine alternate plans to meet objectives
4. Assign dollar values to each of the alternate plans
5. Select a plan for implementation
6. Use the plan you have selected
7. Review the objectives and evaluate the extent to which you are meeting them
8. Keep searching for more efficient alternate plans

The first three steps of the Planning-Programming-Budgeting System are used in developing several alternate plans. The computer is used in step four to calculate the cost of each proposed plan. The

remaining steps (five through eight) constitute a decision making process.

This demonstration uses an example of driver education training which is developed through each of the phases of the Planning-Programming-Budgeting System described above.

This manual is significantly different from the others in the series. It uses some data elements that are created just for this demonstration problem. There is also much more concentration on the part of the problem solution which is done outside the computer than in previous manuals.

PREREQUISITES

You should have studied the MIDAS Reference Manual, as needed and have completed the following Administrator Training units:

- Individual Pupil File Inquiry
- Pupil Directories, Lists, Reports
- Attendance, Mark Reporting, Scheduling
- Staff File Inquiry and Reports

GOALS

The user will have MIDAS

- Calculate various cost data.
- Print out a report showing comparative costs for three plans for teaching driver education.

The user will:

- follow the steps of PPBS in analyzing three alternative methods for teaching driver education.
- enter needed data on a PPBS coding sheet and then access the temporary storage file for comparison and evaluation.



LEARNER OBJECTIVES

Upon completion of this manual, you should be able to

- List the eight steps which constitute PPBS.
- Select the following reason for using a PPBS.
 - public pressure for more efficient operation of schools.
- Select that the computer is most helpful in solving a PPBS problem by assigning costs to each plan.
- Select that limitations on decision-making by PPBS include:
 - political factors are generally not taken into account.
 - projection of future costs are at best "educated guesses."
- Select the fact that the number of teachers needed for each plan would have to be computed along with the average teacher salary.

THE PROBLEM

For the purposes of this demonstration you should assume the role of Superintendent of Schools. You have had a driver education program in your high school for a number of years. It has followed the traditional classroom/behind the wheel format. It has been a popular program and you have received little criticism of it. Recent legislation in your state requires satisfactory completion of a course in driver education by all those who wish to receive a driver's license before their eighteenth birthday. The public schools must make the course available to nonpublic school pupils. You expect a significant increase in driver education enrollments due to this legislation. These enrollment increases will most assuredly result in increased expenditures for driver education.

DEVELOPING PLANS

You elect to employ the techniques of PPBS to aid in deciding upon the teaching methods needed to optimize the benefits received from your driver education expenditures. Let us follow the PPBS steps as previously listed:

Stating Measurable Objectives

Stating measurable objectives is the first step in a Planning-Programming-Budgeting System. Objectives are basic to any instructional program. In a PPBS System it is emphasized that objectives must be measurable and realistic. As Superintendent, you sought the help of your staff, professional literature, insurance companies and university personnel in deciding upon the following objectives for your driver education program.

- It should be an elective course open to all youth of the district who meet the age requirements and who have not previously completed a course in driver education.
- All students satisfactorily completing the course should meet all requirements for a driver's license in your state.
- At least 70% of those students completing the course should achieve a score in the "good range" on the Aaron-Strasser Driver Performance Test.

- At least 90% of the students completing the course should achieve a score of average or above on the Aaron-Strasser Driver Performance Test.
- Pupils should be capable of skillfully executing the following fundamental exercises:
 - a. Parallel Parking
 - b. Angle Parking
 - c. Driveway Turnabout
 - d. Lane Change
 - e. Backing
 - f. Garage Parking
 - g. Hill Parking
- All students who complete the course should score a minimum of 75% on the "Road Check" film test (Aetna series) or on the "Let's Review" film test (Allstate series).
- Students satisfactorily completing the course should have knowledge and simulated experience which will enable them to successfully cope with emergency situations. Competence in this area should be demonstrated by a minimum score of 75% on the "Driving Emergencies" film test (Aetna) or the "Advanced City Driving" film test (Allstate).

- Five year follow-up studies should reveal a significantly below average incidence of moving traffic violations for graduates of this course.
- Five year follow-up studies should reveal a significantly below average incidence of reportable accidents for graduates of this course.

Assigning Priorities to Objectives

Assigning priorities to stated objectives is the second step in a PPB system. All of the objectives listed are reasonable and appropriate. You elect to retain them all and give them equal status. (The assignment of priorities is more applicable to situations in which several new programs are competing for the same available resources.)

Determining Alternate Plans

The third step in a Planning-Programming-Budgeting System is to determine alternate plans to meet the objectives.

Your study revealed three distinct plans for teaching the laboratory phase (driving skills phase) of driver education. You have labeled these plans A, B and C.

Plan A

Plan A is basically the plan being utilized in your school at the present time. It consists of six hours of behind the wheel dual-control driving instruction. Students typically

observe other students drive for 12 hours, but this procedure is employed as a scheduling convenience and has little, if any, educational value in itself.

Plan B

Plan B also uses the behind the wheel dual-control driving technique employed in Plan A; however, the time requirement is reduced from six hours to three hours. The other three hours are replaced by 12 hours of training on a driving simulator.

Plan C

Plan C utilizes the driving simulators in exactly the same manner as Plan B. Six hours of multiple car off-street driving range experience can be substituted for three hours of behind the wheel dual-control driving instruction. However, one hour of the latter must be retained. You nevertheless propose to utilize the full six hours of driving range instruction if you adopt Plan C. Due the initial cost of Plan C and its newness to your state, you feel it is appropriate to be a bit cautious or conservative.

Your study has examined reports claiming the superiority of each of the plans. Most of the literature, however, indicates that there are no inherent educational advantages in any of the plans. Your access to street driving is quite good, you are not frequently prevented from

driving because of the weather, and your accident rate has been quite low. You conclude, therefore, that your objectives will be met equally well with Plan A, B or C. Your decision will be made on the basis of economic advantage.

You have noted that the classroom phase of a driver education program in your state is fixed by law at 30 clock hours, minimum. You may exceed this time allotment if you choose, but a careful study of the course content, the opinion of your driver education staff and the University Safety Personnel and the statements made by the leading insurance companies all indicate that 30 hours of classroom instruction is appropriate no matter what laboratory method you select for teaching the driving skills. You elect to maintain the classroom phase as you have in the past.

COMPUTER CALCULATION OF COSTS

Assigning Dollar Values

The fourth step in a PPB System is to assign dollar values to each of the alternate plans. The direct cost of each of the three plans for teaching driver education involves the number of teachers needed, the salary per teacher, fringe benefits per teacher, and other costs. Plan B has an additional direct cost for providing driving simulators and a room to use them in. Plan C has still other direct costs, those of acquiring four acres of land and developing a multiple car off-street driving range.

Data Files

MIDAS MATH routines will be used in calculating the costs mentioned above. The information for the calculations comes from data files which are stored in the computer. One set of the files are the Personnel Data Files, the other set are the Financial Data Files.

Much of the data for the past years needed to calculate the estimated future costs of Plan A, Plan B and Plan C are readily available from existing data files. Other data needed for projecting costs, such as the cost of providing driving simulators and a driving range, must be input by the school administrator. The cost of maintaining and operating the plant and equipment is estimated to be the same for Plan A, B or C. The cost of providing and maintaining the facilities

for the classroom phase of the program is also the same for each of the plans. Therefore, these costs need not be included in the comparative costs of Plans A, B and C in order to determine the most economically advantageous plan.

In order to obtain accurate cost information on specific programs, it is essential that all direct costs be assigned to that program. Teacher benefits have traditionally been classified as "fixed charges," "substitute teachers," etc. In a PPBS, we need to reorient our budgeting--if not our basic accounting system--to enable us to readily and accurately attach these costs to the appropriate programs.

You will have to estimate fringe benefit percentages for the years 1970-1971 through 1974-1975. However, projected or estimated Average Teacher Salary Schedule Matrix Indices multiplied by the administrator's best estimate of the base salaries for future years, is probably the most reliable projection of Average Teacher Costs for Salaries available. This is the technique which will be used in this demonstration.

And, of course, the Average Teacher Cost for Salary added to the Average Teacher Cost for Fringe Benefits equals the Average Cost of Employing a Teacher.

Thus far in determining the costs of three plans we have discussed the methods of determining the average cost per teacher. You now

PPBS - Coding Sheet (PPBSSRES)

G800 - PPBS Data

E068 - Fiscal Year (9)A	
E801 - Base Salary (6)N	-- -- -- -- --
E802 - Salary Schedule Index (4)N	-- -- -- -- --
E803 - Fringe Benefit Percentage (5)N	-- -- -- -- --
E813 - Plan A Onetime Cost (6)N	
E814 - Plan A Other Costs (6)N	-- -- -- -- --
E815 - Plan B Onetime Cost (6)N	
E816 - Plan B Other Costs (6)N	-- -- -- -- --
E817 - Plan C Onetime Cost (6)N	-- -- -- -- --
E818 - Plan C Other Costs (6)N	-- -- -- -- --
E819 - Estimated Enrollment (3)N	-- -- --
E820 - Section Size - Classroom (4)N	
E821 - Section Size - Driving Range (4)N	-- -- -- --
E822 - Section Size - Simulator (4)N	-- -- -- --
E823 - Hours Behind Wheel (4)N	-- -- -- --
E824 - Hours Classroom (4)N	-- -- -- --
E825 - Hours Driving Range (4)N	
E826 - Hours Simulator (4)N	-- -- -- --
E827 - Instruction Hours/Teacher/Year (4)N	-- -- -- --

have to determine the number of teachers needed for each of the plans.

Several factors influence the number of teachers needed:

Enrollment Driver Education, Estimated

Average Section Size, Classroom

Average Section Size, Driving Range

Average Section Size, Driving Simulator

Hours Instruction Behind Wheel

Hours Instruction, Classroom

Hours Instruction, Driving Range

Hours Instruction, Driving Simulator

Hours Instructing Per Teacher Per Year

Data File - Coding Sheet

In actual practice, you would have prepared all of the five year cost estimates on a worksheet such as the coding sheet on the facing page. These data would have been derived from previous computer runs or developed from other sources.

As you go through this section of the manual, you will be filling out the data for one school term on a coding sheet. Tear out one of the blank coding sheets from the back of the manual; use it for recording your data.

The first data element you enter is the school term, E068. For this demonstration you will use the data for the school term 1970-1971.

On your coding sheet enter the school term data.

The next element is E801 and all others for this file follow in consecutive order, i.e., E801, E802, E803 . . . E827.

For each of the data items described enter the element identifier and the value for only the school term 1970-1971.

Salary Schedule Base Salary

The use of salary schedule indices causes the cost of teacher salaries to be closely related to the Salary Schedule Base Salary. To predict future base salaries is difficult, but it must be done. With a view to the trend in the past decade, your understanding of teacher and community pressures and the national economy in general, you estimate that the base salaries for the next five years will be \$7,500, \$7,800, \$8,100, \$8,500 and \$8,700 respectively.

On your coding sheet remember to enter the element value for only the school term 1970-1971.

Salary Schedule Matrix Index

Another crucial element in projecting costs is the Salary Schedule Matrix Index value expected for the driver education teachers. You could plan to select teachers with certain training and experience levels; however, your board policies suggest that you should hire "the best qualified candidate." You may have all teachers at the top of the salary

schedule. However, you conclude that your best estimate for the next five years for driver education teachers is the same as expected for all high school teachers. Reliable estimates of that figure for the next five years, based on a rather straight 10 year experience line are 1.40, 1.44, 1.50, 1.56, and 1.60.

Remember to enter the value on the coding sheet.

Fringe Benefits (E803)

Percentage figures which include the total fringe benefit costs are estimated for the next five years to be 18.1, 18.1, 18.5, 19.3, and 19.3. This includes social security, retirement, hospitalization, disability insurance, workmens compensation, and replacement by substitute teachers.

Cost of Plan A - Onetime (E813)

There are no one time costs anticipated for continuing to teach driver education under Plan A.

Cost of Plan A - Others (E184)

The other costs for Plan A include books, supplies, auto insurance, gasoline and teacher conferences. They are estimated to be quite reflective of enrollments with a slight inflationary increase. You estimate them to be \$9,555, \$9,920, \$11,420, \$11,570 and \$12,056 for each of the next five years respectively.

Cost of Plan B - Onetime (E815)

Plan B has a first year cost for an additional room and the purchase of sixteen simulators. With the help of your architect and business manager you estimate the onetime cost of Plan B to be \$40,300.

Cost of Plan B - Other (E816)

Although the objects of expenditures would vary slightly, you estimate the other costs of Plan B to be the same as for Plan A (and C).

Cost of Plan C - Onetime (E817)

Plan C has the same first year costs as for Plan B plus the additional costs of purchasing four acres of land and developing a driving range. Again with the help of your architect and business manager, you estimate the onetime cost of Plan C to be \$220,800.

Cost of Plan C - Other (E818)

Again, the objects of expenditure would vary slightly, but the total other costs of Plan C are estimated to be the same as for Plan A and Plan B.

Average Section Size - Classroom (E820)

Your school district has an agreement with the Local Education Association that section sizes shall not exceed 31 pupils. You conclude that your Average Section Size for Classroom instruction will be 28.0 students regardless of which plan is adopted.

Average Section Size - Driving Range (E821)

Your driving range under Plan C can accomodate 12 cars at one time; however, you conclude that your average section size on the driving range will be 11.0 pupils.

Average Section Size - Simulator (E822)

Although you would purchase 16 driving simulators under Plan B or Plan C, you conclude that the average section size for the driving simulators would probably be 14.5.

Hours of Instruction Behind the Wheel (E823)

You decide to continue offering 6.0 hours of instruction behind the wheel if Plan A is adopted, 3.0 hours under Plan B, and 1.0 hours under Plan C.

Hours of Instruction - Classroom (E824)

You decide that 30 hours of instruction in the classroom will be offered regardless of which plan is adopted.

Hours of Instruction - Driving Range (E825)

If Plan C is adopted, you will offer six hours instruction on the driving range.

Hours of Instruction - Simulator (E826)

You decide that if either Plan B or Plan C is adopted, you will offer 12.0 hours of instruction with the driving simulator.

Hours of Instruction per Teacher per Year (E827)

Your teacher contracts call for 180 teaching days. However, to account for periods lost to assemblies, testing, driver's exams, and other interruptions, the 180 "teaching days" are reduced to 160. One hundred sixty days multiplied by 5 teaching hours per day equals 800 hours of instruction per teacher per year.

Call out the OLD file named PPBSSRES from the computer storage unit. (Follow the procedure on page 9 of the Teletypewriter Procedures Manual.) After the computer has printed READY, type in the system command to list this file.

After the listing of the file is completed, sign off the computer by typing BYE.

Compare the printed listing with your entries on the Data Coding Sheet.

Check for the following points:

- Is each data value entry preceded by an element identifier?
- Is each element identifier preceded by a group identifier?

(A listing of this file is printed in Appendix B.)

Notice that this file contains a group designator as well as an element designator accompanying each data value. The previous data files you used contain a group designator only with the first data value. Because all of the data in the PPBS Data File will be used in this problem, running SEARCH will not be necessary. Thus, this file is entered

and used as a SEARCH Result File.

You will need to run CONVERT using the file (PPBSSRES) as the temporary storage file and the usual SEARCH Result File (SRESFILE) as the permanent storage file. In this way you only need to run MATH and PRINT by-passing SEARCH and its retrieval of your data.

"MIDAS"
PRINT LAYOUT SHEET

User's Name		DATE	
Report Title		PAGE	
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100

COMPARATIVE COST REPORT

Design a report which will show the total cost of each plan for each year and will show the difference in cost in the plans for each year (subtract the cost of Plan A from the other two and then the cost of Plan B from the cost of Plan C.) You may include any other data you feel is needed for decision making.

Formulas and methods for calculating the various parts of the report are printed in Appendix A. The completed request files are printed in Appendix B; try completing the problem before referring to them. One method for printing this report is shown in the following dialogue with the computer.

Executing MIDAS

OLD MIDAS
READY
RUN

MIDAS 13:54 L 08/05/71

ALL RIGHTS RESERVED BY NORTHWEST REGIONAL EDUCATIONAL LABORATORY
OCTOBER 1, 1969

KAYE BREITENBUCHER-COMPUTER PROGRAMMER
BONNIE VELLA - PROGRAMMER-ANALYST
CLIFF WINKLER - SYSTEM ANALYST
DICK LYNCH - TECHNICAL ADVISOR

DO YOU NEED A LIST OF VALID COMMANDS?? NO

YOUR COMMAND? CONVERT
ENTER VALIDATION FILE NAME
? VALFILE
ENTER TEMPORARY STORAGE FILE NAME
? PPBSSRES

ENTER PERMANENT STORAGE FILE NAME
? SRESFILE
IS THIS A DATA BASE FILE
? NO--YES
ENTER NEXT TEMPORARY FILE NAME
? NONE
NO ERRORS HAVE BEEN FOUND
PLEASE WAIT WHILE CONVERT IS IN PROCESS
PPBSSRES BEING CONVERTED
CONVERT IS NOW COMPLETED

(The PPBS Data File (PPBSSRES) is a temporary file and is structured as a SEARCH Result File. It must be converted to a permanent file and used like a result file containing data retrieved by SEARCH. Thus the permanent file name to be used is SRESFILE.)

YOUR COMMAND? CONVERT
ENTER VALIDATION FILE NAME
? VALFILE
ENTER TEMPORARY STORAGE FILE NAME
? PPBSMRQ

ENTER PERMANENT STORAGE FILE NAME
? MREQFILE
IS THIS A DATA BASE FILE
? NO
CONVERT IS NOW COMPLETED

YOUR COMMAND? CONVERT
ENTER VALIDATION FILE NAME
? VALFILE
ENTER TEMPORARY STORAGE FILE NAME
? PPBSPRQ

ENTER PERMANENT STORAGE FILE NAME
? PREQFILE
IS THIS A DATA BASE FILE
? NO
CONVERT IS NOW COMPLETED

(Now it is not necessary to run SEARCH - instead
go directly to MATH, using SRESFILE as your
SEARCH Result File.)

YOUR COMMAND? MATH
ENTER VALIDATION FILE NAME
? VALFILE
ENTER MATH REQUEST FILE NAME
? MREQFILE
ENTER SEARCH RESULT FILE NAME
? SRESFILE
ENTER MATH RESULT FILE NAME
? MRESFILE
HAVE MATH REQUESTS BEEN SAVED
? YES
DO YOU HAVE ANY CONSTANTS TO BE INPUT
? NO

PLEASE WAIT WHILE MATH IS IN PROCESS.
END MATH-DO YOU WANT MATH RESULTS LISTED
? NO

YOUR COMMAND? PRINT
 INPUT FILE NAMES
 VALIDATE FILE
 ? VALFILE
 CATEGORY FILE
 ? KATFIL
 REQUEST FILE NAME
 ? PREQFILE
 SEARCH RESULT FILE
 ? SRESFILE
 MATH RESULT FILE
 ? MRESFILE
 ARE YOU PRINTING MATH RESULTS
 ? YES
 HAVE PRINT REQUESTS BEEN SAVED
 ? YES

PAGE 1

08/05/71

DRIVER EDUCATION COMPARATIVE COSTS FOR THREE PLANS

FISCAL YEAR	1970-1971
ESTIMATED ENROLLMENT	318
AVERAGE TEACHER SALSRY	10500
FRINGE BENEFIT COSTS	190050.
TOTAL TEACHER COST	200550
NO. TEACHERS - PLAN A	2.47017
TEACHER COST - PLAN A	495393.
ONETIME COST - PLAN A	0
OTHER COSTS - PLAN A	9555
TOTAL COST - PLAN A	504948
NO. TEACHERS - PLAN B	2.79914
TEACHER COST - PLAN B	561368.
ONETIME COST - PLAN B	40300
OTHER COSTS - PLAN B	9555
TOTAL COST - PLAN B	611223
NO. TEACHERS - PLAN C	3.01595
TEACHER COST - PLAN C	604849.
ONETIME COST - PLAN C	220800
OTHER COSTS - PLAN C	9555
TOTAL COST - PLAN C	835204
COST PLAN B LESS COST PLAN A	106275
COST PLAN C LESS PLAN A	330256
COST PLAN C LESS PLAN B	223981

DRIVER EDUCATION COMPARATIVE COSTS FOR THREE PLANS

FISCAL YEAR	1970-1971	1971-1972	1972-1973	1973-1974	1974-1975
ESTIMATED ENROLLMENT	318	327	346	351	365
AVERAGE TEACHER SALARY	10500	11232	12150	12750	13050
FRINGE BENEFIT COSTS	190050.	203299.	224775	246075	251865
TOTAL TEACHER COST	200550	214531	236925	258825	264915
NO. TEACHERS - PLAN A	2.47017	2.54009	2.68768	2.72651	2.83526
TEACHER COST - PLAN A	495393.	544928.	636779.	705689.	751103.
ONETIME COST - PLAN A	0	0	0	0	0
OTHER COSTS - PLAN A	9555	9920	11420	11570	12056
TOTAL COST - PLAN A	504948	554848	648199	717259	763159
NO. TEACHERS - PLAN B	2.79914	2.87836	3.04561	3.08961	3.21285
TEACHER COST - PLAN B	561368.	617497.	721581.	799668.	851132.
ONETIME COST - PLAN B	40300	0	0	0	0
OTHER COSTS - PLAN B	9555	9920	11420	11570	12056
TOTAL COST - PLAN B	611223	627417	733001	811238	863188
NO. TEACHERS - PLAN C	3.01595	3.10131	3.28153	3.32893	3.46171
TEACHER COST - PLAN C	604849.	665327.	777476.	861610.	917059.
ONETIME COST - PLAN C	220800	0	0	0	0
OTHER COSTS - PLAN C	9555	9920	11420	11570	12056
TOTAL COST - PLAN C	835204	675247	788896	873180	929115
COST PLAN B LESS PLAN A	106275	72569	84802	93979	100029
COST PLAN C LESS PLAN A	330256	120399	140697	155921	165956
COST PLAN C LESS PLAN B	223981	47830	55895	61942	65927

DECISION MAKING

Selecting a Plan

Selecting a plan for implementation is the fifth step in a PPBS System. The computer could have been programmed to select the plan to adopt in accordance with your criteria. For example, you could have programmed the computer to analyze all of the data available and tell you the year during which the cumulative economic advantages of Plan B (or C) would exceed the costs of implementing that Plan. Or, the computer could have been programmed to tell you the year during which Plan B or C should be adopted so that the cumulative financial advantage of that plan over Plan A will be exceeded by a certain percent after a specified number of years.

Most administrators are not willing to have the computer make decisions for them. Most administrators prefer the type of report you have just received. It enables them to study the comparative costs carefully.

Study the display you have just received. Note that the adoption of Plan B would result in cumulative savings, at the end of the fifth year, of \$29,676 over Plan A and \$133,586 over Plan C. It appears that eventually Plan C would be the most advantageous plan economically. But remember the concern you had earlier about the difficulty of making valid teacher cost estimates beyond a five year period. You will logically conclude that the economic advantages of adopting Plan B are sufficient

to warrant the initial one-time expenditure of \$40,300.

(Note: The data input for this problem were the result of careful study and analysis. You believe them to be valid and free from bias. You could have also run a set of conservative data, i.e., data that tends to support the status quo. In this case, such data would have shown lower Salary Schedule Base Salary Indices estimates and higher one-time cost estimates for Plans B and C. If that study also indicates an economic advantage for adopting Plan B, you would be extremely comfortable in adopting it. Conversely, a data input predicting higher Base Salaries for the next five years would bias the results in favor of adopting Plans B or C. If even these liberal teacher cost estimates fail to show an economic advantage for Plan C, you can be very comfortable in your decision not to adopt Plan C. If the three displays suggest totally divergent courses of action, you should stick with the display resulting from your best estimate, reexamine your data input, or both.)

Implementing the Plan

The sixth step in a PPB System is to use the plan you have selected. Once a plan has been selected it should be implemented as planned. Should you encounter evidence that the study just completed is in error (i.e., the 1970-1971 Base Salary has been set at considerable variance

from your estimate), prepare new estimates, re-run and evaluate new results in the light of present commitments.

Review and Evaluating Objectives

The seventh step in a PPB system is to review the objectives and evaluate the extent to which you are meeting them. The need for a review of the objectives of any educational program seems apparent. It is no less true with a PPBS application. PPBS objectives are measurable. You have the responsibility to determine the extent to which they are being fulfilled.

Searching for Alternate Plans

The final step in a Planning-Programming-Budgeting System is to keep searching for more efficient alternate plans. Again this step in PPBS seems self-evident; yet there is a danger that the decision based on our own careful studies may be blinded - and perhaps unjustifiable - against the light of later truth.

APPENDIX A

	<u>Page</u>
Number of Teachers	29
Teacher Cost	31
Cost for Plan A	32

NUMBER OF TEACHERS

To calculate the number of teachers needed for each plan, use the following methods and formulas.

Plan A - Formula and Method

$$\frac{(E819 \times E823) + \left(\frac{E819 \times E824}{E820} \right)}{E827}$$

The estimated enrollment (E819) is multiplied by the hours of instruction behind the wheel (E823). This product is added to quotient obtained by dividing the classroom section size (E820) into the product of the hours of classroom instruction (E824) and the estimated enrollment (E819). The sum obtained is then divided by the hours of instructing per teacher per year (E827).

The series of MATH requests for MIDAS to calculate this are as follows:

```
110 MUL,G800,E819,BY,G800,E823,STORE,R008,V001
120 MUL,G800,E819,BY,G800,E824,STORE,R008,V002
130 DIV,R008,V001,BY,G800,E820,STORE,R008,V003
140 ADD,R008,V001,T0,R008,V003,STORE,R008,V004
150 DIV,R008,V004,BY,G800,E827,STORE,R008,V005
```

Plan B - Formula and Method

$$\frac{(E819 \times E823) + \left(\frac{E819 \times E824}{E820} \right) + \left(\frac{E819 \times E826}{E822} \right)}{E827}$$

The series of MATH requests for MIDAS to calculate this are as follows:

```

110 MUL,G800,E819,BY,G800,E823,STORE,R008,V001
120 MUL,G800,E819,BY,G800,E824,STORE,R008,V002
130 DIV,R008,V001,BY,G800,E820,STORE,R008,V003
140 ADD,R008,V001,T0,R008,V003,STORE,R008,V004
150 DIV,R008,V004,BY,G800,E827,STORE,R008,V005
160 MUL,G800,E819,BY,G800,E826,STORE,R008,V006
170 DIV,R008,V006,BY,G800,E822,STORE,R008,V007
180 ADD,R008,V004,T0,R008,V007,STORE,R008,V008
190 DIV,R008,V008,BY,G800,E827,STORE,R008,V009

```

Plan C - Formula and Method

$$\frac{(E819 \times E823) + \left(\frac{E819 \times E824}{E820} \right) + \left(\frac{E819 \times E826}{E822} \right) + \left(\frac{E819 \times E825}{E821} \right)}{E827}$$

```

110 MUL,G800,E819,BY,G800,E823,STORE,R008,V001
120 MUL,G800,E819,BY,G800,E824,STORE,R008,V002
130 DIV,R008,V001,BY,G800,E820,STORE,R008,V003
140 ADD,R008,V001,T0,R008,V003,STORE,R008,V004
150 DIV,R008,V004,BY,G800,E827,STORE,R008,V005
160 MUL,G800,E819,BY,G800,E826,STORE,R008,V006
170 DIV,R008,V006,BY,G800,E822,STORE,R008,V007
180 ADD,R008,V004,T0,R008,V007,STORE,R008,V008
190 DIV,R008,V008,BY,G800,E827,STORE,R008,V009
200 MUL,G800,E819,BY,G800,E825,STORE,R008,V010
210 DIV,R008,V010,BY,G800,E821,STORE,R008,V011
220 ADD,R008,V008,T0,R008,V011,STORE,R008,V012
230 DIV,R008,V012,BY,G800,E827,STORE,R008,V013

```


TEACHER COST

The average teacher cost for one teacher is the sum of the average salary and the average fringe benefit costs. The average salary for one teacher is the product of the base salary (E801) and the salary schedule matrix index (E802). The cost for fringe benefits is found by multiplying the average salary by the fringe benefit percentage figure (E803).

The series of MATH requests for MIDAS to calculate this are:

```
240 MUL,G800,E801,BY,G800,E802,STORE,R008,N014
250 MUL,R008,N014,BY,G800,E803,STORE,R008,N015
260 ADD,R008,N014,T0,R008,N015,STORE,R008,N016
```

COST FOR PLAN A

The cost for Plan A is the sum of the teacher cost for Plan A, the onetime cost for Plan A and the other costs for Plan A.

The series of MATH requests for MIDAS to calculate this are:

```
270 MUL,R008,V005,BY,R008,V016,STORE,R008,V017
280 ADD,R008,V017,TO,G800,E813,STORE,R008,V018
290 ADD,R008,V018,TO,G800,E814,STORE,R008,V019
```

The cost for Plan B and Plan C are calculated in a similar manner using the appropriate data values.

APPENDIX B

	<u>Page</u>
PPBS - Coding Sheet	34
PPBS - Data File (PPBSSRES)	35
MATH Request File (PPBSMRQ)	36
PRINT Request File (PPBSPRQ)	37

PPBS - Coding Sheet (PPBSSRES)

G800 - PPBS Data

E068 - Fiscal Year (9)A	---
E801 - Base Salary (6)N	---
E802 - Salary Schedule Index (4)N	---
E803 - Fringe Benefit Percentage (5)N	---
E813 - Plan A Onetime Cost (6)N	---
E814 - Plan A Other Costs (6)N	---
E815 - Plan B Onetime Cost (6)N	---
E816 - Plan B Other Costs (6)N	---
E817 - Plan C Onetime Cost (6)N	---
E818 - Plan C Other Costs (6)N	---
E819 - Estimated Enrollment (3)N	---
E820 - Section Size - Classroom (4)N	---
E821 - Section Size - Driving Range (4)N	---
E822 - Section Size - Simulator (4)N	---
E823 - Hours Behind Wheel (4)N	---
E824 - Hours Classroom (4)N	---
E825 - Hours Driving Range (4)N	---
E826 - Hours Simulator (4)N	---
E827 - Instruction Hours/Teacher/Year (4)N	---

PPBS DATA FILE (PPBSRES)

PPBSRES

100 G800,E068,1970-1971,G800,E801,7500,G800,E802,1.40,G800,E803,18.1,
110 G800,E813,0,G800,E814,9555,G800,E815,40300,
120 G800,E816,9555,G800,E817,220800,G800,E818,9555,G800,E819,318,
130 G800,E820,28.0,G800,E821,11.0,G800,E822,14.5,G800,E823,6.0,
140 G800,E824,30.0,G800,E825,6.0,G800,E826,12.0,G800,E827,800,
150 RM,
160 G800,E068,1971-1972,G800,E801,7800,G800,E802,1.44,G800,E803,18.1,
170 G800,E813,0,G800,E814,9920,G800,E815,0,
180 G800,E816,9920,G800,E817,0,G800,E818,9920,G800,E819,327,
190 G800,E820,28.0,G800,E821,11.0,G800,E822,14.5,G800,E823,6.0,
200 G800,E824,30.0,G800,E825,6.0,G800,E826,12.0,G800,E827,800,
210 RM,
220 G800,E068,1972-1973,G800,E801,8100,G800,E802,1.50,G800,E803,18.5,
230 G800,E813,0,G800,E814,11420,G800,E815,0,
240 G800,E816,11420,G800,E817,0,G800,E818,11420,G800,E819,346,
250 G800,E820,28.0,G800,E821,11.0,G800,E822,14.5,G800,E823,6.0,
260 G800,E824,30.0,G800,E825,6.0,G800,E826,12.0,G800,E827,800,
270 RM,
280 G800,E068,1973-1974,G800,E801,8500,G800,E802,1.50,G800,E803,19.3,
290 G800,E813,0,G800,E814,11570,G800,E815,0,
300 G800,E816,11570,G800,E817,0,G800,E818,11570,G800,E819,351,
310 G800,E820,28.0,G800,E821,11.0,G800,E822,14.5,G800,E823,6.0,
320 G800,E824,30.0,G800,E825,6.0,G800,E826,12.0,G800,E827,800,
330 RM,
340 G800,E068,1974-1975,G800,E801,8700,G800,E802,1.50,G800,E803,19.3,
350 G800,E813,0,G800,E814,12056,G800,E815,0,
360 G800,E816,12056,G800,E817,0,G800,E818,12056,G800,E819,365,
370 G800,E820,28.0,G800,E821,11.0,G800,E822,14.5,G800,E823,6.0,
380 G800,E824,30.0,G800,E825,6.0,G800,E826,12.0,G800,E827,800,
390 RM
400 ENDS

MATH Request File

PPBSMRQ

100 28
110 MUL,G800,E819,BY,G800,E823,STORE,R008,N001
120 MUL,G800,E819,BY,G800,E824,STORE,R008,N002
130 DIV,R008,N001,BY,G800,E820,STORE,R008,N003
140 ADD,R008,N001,TO,R008,N003,STORE,R008,N004
150 DIV,R008,N004,BY,G800,E827,STORE,R008,N005
160 MUL,G800,E819,BY,G800,E826,STORE,R008,N006
170 DIV,R008,N006,BY,G800,E822,STORE,R008,N007
180 ADD,R008,N004,TO,R008,N007,STORE,R008,N008
190 DIV,R008,N008,BY,G800,E827,STORE,R008,N009
200 MUL,G800,E819,BY,G800,E825,STORE,R008,N010
210 DIV,R008,N010,BY,G800,E821,STORE,R008,N011
220 ADD,R008,N008,TO,R008,N011,STORE,R008,N012
230 DIV,R008,N012,BY,G800,E827,STORE,R008,N013
240 MUL,G800,E801,BY,G800,E802,STORE,R008,N014
250 MUL,R008,N014,BY,G800,E803,STORE,R008,N015
260 ADD,R008,N014,TO,R008,N015,STORE,R008,N016
270 MUL,R008,N005,BY,R008,N016,STORE,R008,N017
280 ADD,R008,N017,TO,G800,E813,STORE,R008,N018
290 ADD,R008,N018,TO,G800,E814,STORE,R008,N019
300 MUL,R008,N009,BY,R008,N016,STORE,R008,N020
310 ADD,R008,N020,TO,G800,E815,STORE,R008,N021
320 ADD,R008,N021,TO,G800,E816,STORE,R008,N022
330 MUL,R008,N013,BY,R008,N016,STORE,R008,N023
340 ADD,R008,N023,TO,G800,E817,STORE,R008,N024
350 ADD,R008,N024,TO,G800,E818,STORE,R008,N025
360 SUB,R008,N019,FROM,R008,N022,STORE,R008,N026
370 SUB,R008,N019,FROM,R008,N025,STORE,R008,N027
380 SUB,R008,N022,FROM,R008,N025,STORE,R008,N028
390 RM
400 ENDS

PRINT Request File

PPBSPRQ

100 1
110 30
120 1
130 TTL, DRIVER EDUCATION COMPARATIVE COSTS FOR THREE PLANS, 10
140 1
150 EOP, N, 2
160 2
170 HDG, FISCAL YEAR, 1
180 G800, E068, 35
190 2
200 HDG, ESTIMATED ENROLLMENT, 1
210 G800, F819, 35
220 2
230 HDG, AVERAGE TEACHER SALARY, 1
240 R008, N014, 35
250 2
260 HDG, FRINGE BENEFIT COSTS, 1
270 R008, N015, 35
280 2
290 HDG, TOTAL TEACHER COST, 1
300 R008, N016, 35
310 1
320 EOP, N, 1
330 2
340 HDG, NO. TEACHERS - PLAN A, 1
350 R008, N005, 35
360 2
370 HDG, TEACHER COST - PLAN A, 1
380 R008, N017, 35
390 2
400 HDG, ONETIME COST - PLAN A, 1
410 G800, E813, 35
420 2
430 HDG, OTHER COSTS - PLAN A, 1
440 G800, E814, 35
450 2
460 HDG, TOTAL COST - PLAN A, 1
470 R008, N019, 35
480 1
490 EOP, N, 1
500 2
510 HDG, NO. TEACHERS - PLAN B, 1
520 R008, N009, 35

PRINT Request File
(cont.)

530 2
540 HDG,TEACHER COST - PLAN B,1
550 R008,N020,35
560 2
570 HDG,ONETIME COST - PLAN B,1
580 G800,E815,35
590 2
600 HDG,OTHER COSTS - PLAN B,1
610 G800,E816,35
620 2
630 HDG,TOTAL COST - PLAN B,1
640 R008,N022,35
650 1
660 EOP,N,1
670 2
680 HDG,NO. TEACHERS - PLAN C,1
690 R008,N013,35
700 2
710 HDG,TEACHER COST - PLAN C,1
720 R008,N023,35
730 2
740 HDG,ONETIME COST - PLAN C,1
750 G800,E817,35
760 2
770 HDG,OTHER COSTS - PLAN C,1
780 G800,E818,35
790 2
800 HDG,TOTAL COST - PLAN C,1
810 R008,N025,35
820 1
830 EOP,N,1
840 2
850 HDG,COST PLAN B LESS PLAN A,1
860 R008,N026,35
870 2
880 HDG,COST PLAN C LESS PLAN A,1
890 R008,N027,35
900 2
910 HDG,COST PLAN C LESS PLAN B,1
920 R008,N028,35
930 1
940 EOP,N,4
950 PM
960 FNDS

APPENDIX C

GLOSSARY OF TERMS

Driving Simulator

An electro-mechanical device designed to represent the driver's compartment of an automobile, including typical controls and gauges, along with a set of programmed films that assist in the learning of fundamental skills and the application of these skills in typical and emergency driving situations. The simulator has the advantage of safety coupled with a variety of experiences impossible to achieve through six hours of driving experience. Simulators can be operated independent of local weather conditions which might hamper effective behind the wheel instruction.

Driving simulators typically replace one-half of the behind the wheel requirement at a rate of four hours of simulator for one hour of behind the wheel dual-control driving.

Multiple Car Off-Street Driving Range

A facility designed to provide most of the behind the wheel driving experiences needed in a driver training program without the problems and hazards of real traffic. A number of student-operated automobiles are used simultaneously to provide laboratory instruction.

One instructor typically supervises the driving from an observation tower, room or point. His oral instructions are transmitted to the student driver through megaphone, bullhorn or transistor radios in the cars.

The driving range is approximately 4 acres in size and includes:

1. Space for development of fundamental skills
2. Road surfaces wide enough for two way and multiple lane traffic
3. Intersection, curves and grades
4. Land markings, sign and signals
5. Office space, small classroom with range model, observation room or tower, and a means of communication with the students

PPBS - Coding Sheet (PPBSSRES)

G800 - PPBS Data

E068 - Fiscal Year (9)A	---
E801 - Base Salary (6)N	-----
E802 - Salary Schedule Index (4)N	-----
E803 - Fringe Benefit Percentage (5)N	-----
E813 - Plan A Onetime Cost (6)N	-----
E814 - Plan A Other Costs (6)N	-----
E815 - Plan B Onetime Cost (6)N	-----
E816 - Plan B Other Costs (6)N	-----
E817 - Plan C Onetime Cost (6)N	-----
E818 - Plan C Other Costs (6)N	-----
E819 - Estimated Enrollment (3)N	---
E820 - Section Size - Classroom (4)N	----
E821 - Section Size - Driving Range (4)N	----
E822 - Section Size - Simulator (4)N	----
E823 - Hours Behind Wheel (4)N	----
E824 - Hours Classroom (4)N	----
E825 - Hours Driving Range (4)N	----
E826 - Hours Simulator (4)N	----
E827 - Instruction Hours/Teacher/Year (4)N	----

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- a) Books that have been published since 1969 relative to computers and/or their uses.
- b) Articles that have been published since 1967 relative to computers and/or their uses.

The references are listed in five categories:

- I Computers and Education
- II Computer Science
- III Uses of Computers (other than educational uses)
- IV Programming
- V Social Implications of the Computer

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- (b) same as (a) but for individual learners in the class
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- (d) list of small group activities

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